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AMERICAN MACHINIST

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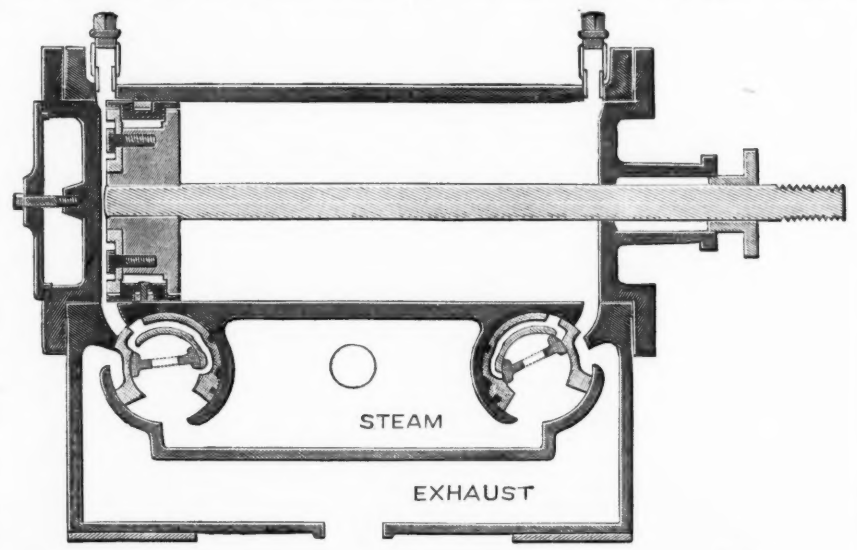
The Twiss Improved Automatic Cut-off Engine.

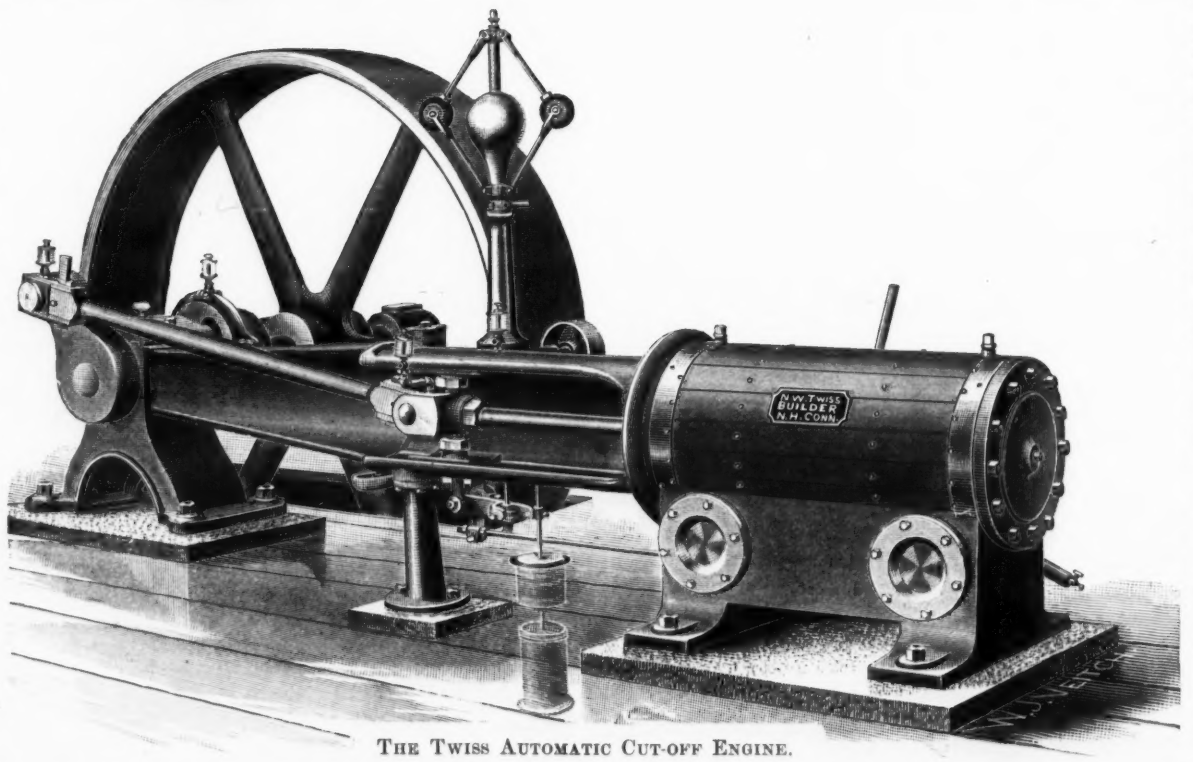
The accompanying illustrations (pages 1 and 2) represent an automatic cut-off engine recently brought out by Nelson W. Twiss, 28 Whitney avenue, New Haven, Conn. Its general design is similar to that of the Corliss or girder type, and possesses simplicity, durability and strength. The cylinder, frame and pillow block are cast separate and bolted together. The frame is squared up and the guides bored out at the same time, thus securing perfect alignment with the cylinder. At each end of the steam chest is a circular valve chamber, with ports communicating respectively with the steam compartment, cylinder and exhaust passage. The two main valves are journaled within these chambers, and are made with circular valve seats for the reception of the cut-off valves, journaled within the main valves and concentric with them. Steam enters the cut-off valve chambers through suitable openings in the main valves. Each cut-off valve admits steam through two nearly oppositely arranged steam port openings into an annular passage within the body of the main valve, and which is adapted to connect with the cylinder port. With these oppositely arranged ports the cut-off valve is partially balanced, and a double opening is secured for a given travel, but they are sufficiently off the center to insure the valves being properly seated by the steam pressure.

The main valve is formed with the usual exterior exhaust cavity adapted to span the steam and exhaust ports, and is nearly balanced by packing rings and strips, inclosing a balancing area opposite the exhaust cavity, the balancing area being proportioned to insure the valve being properly seated by steam pressure. A passage through the main valve connecting the balancing area with the exhaust cavity is provided, to insure the escape of leakage into the balancing area.

The valve drivers engage and operate the valves by means of suitable lugs or projections on the valves and corresponding recesses in the drivers, which construction permits the removal of the valve from the opposite end of the valve chambers without disturbing the valve gear. The stems of the main drivers are hollow, and journaled through the long bonnets of the valve chambers, with cranks or rock-arms keyed upon their outer ends. These cranks are connected by an adjustable connecting rod, and operated by an eccentric on the main shaft and suitable connections, which, in all sizes, may be disengaged, to allow the engine to be reversed or worked by hand. Both main valves vibrate together as a single plain valve, and control the steam admissions and exhausts.

The cut-off valve drivers are journaled in and project through the stems of the main drivers, and have arms keyed upon their outer ends, by which they may be hooked to and vibrated together with the main valve cranks in their open positions, a suitable catch or latch link being provided on each main valve crank for that purpose, and adapted to be liberated by striking a suitable tripping cam, which is operated by the governor, to regulate the point of cut-off, the range of cut-off being from zero to nearly half stroke.





THE TWISS AUTOMATIC CUT-OFF ENGINE.

The closing of the cut-off valve is effected by a spiral spring, one end of which is connected with the main valve crank, and the other end is connected with a hollow cup or cover which incloses the spring and is secured to the cut-off valve stem by a set-screw, thus securing a convenient method of adjusting the tension of the spring. The opening of the cut-off valve is effected by a stationary stop engaging the arm of the cut-off valve, which, by the continued advance of the main valve crank, opens the cut-off valve, and also winds up the spring, restoring the tension at each stroke.

To secure the quiet closing of the cut-off valve, an air cylinder is secured to the main valve crank and vibrates with it; an air-tight piston is fitted to it and connected with the cut off valve arm, which in closing confines a portion of the air in the cylinder, the amount being regulated by a pet-cock.

This valve gear gives an excellent distribution of steam, as the indicator card plainly shows. The speed of the engine may be changed by adding or removing weights from the governor.

Making Metal Wheels.

BY B. F. SPALDING.

It is desirable that the steps by which great changes are made in the things which concern the general welfare should be noted before all traces of them are lost. It will not be amiss, therefore, to further describe the making of vehicle wheels from metal, because the change from the material of which they have been made, hitherto, the change from wood to metal, is so great as to amount to a revolution Every one is concerned with wheels. "Everything that goes, goes on wheels." If mud stops wheels from running on the country roads—the venous system—the wheels will stop running on the arterial system, the great through railways, and the circulation is impeded. When the wheels stop, business stagnates.

One branch of a metal wheel manufactory, established 500 miles from the parent stem, is now making about 10,000 wheels per week, at an average cost of probably a dollar apiece, and an average weight of 25 pounds each. They are made in all varieties, from heavy strong wheels, suitable for a city dray, to the light wheels for cultivators, varying in weight from 110 pounds each down to 14 pounds. The tires used are from six inches wide down to one inch, and the diameters range from 18 to 60 inches. This large number of wheels runs into stock heavily. When it is considered that this is only one branch of one establishment, and that there are a number of concerns engaged in the business, it will be seen that it has grown like Jonah's gourd, and it may also be observed that its promoters have not been asleep while it was growing.

The exigencies of this new manufacture have brought into regular employment some peculiarities in working cast and wrought-iron and steel, of which greater advantage is taken than has been previously customary. The casting of the hubs is an instance, as they are cast in permanent iron molds, without injurious chilling of the cast-metal. In the operation of fastening the spokes into

the hubs and tires of other wheels, also, dependence is placed for the success of the operation upon the ability to compel the cold flowing of the wrought-metal, by bringing sufficient pressure to bear upon the spokes while they are subjected to a grip strong enough to withstand it.

In the method, described in a previous paper, of manufacturing metal wheels, the welding of the tire was the last operation except the truing up, but other methods, in quite as extensive use, require that the tire shall be welded in the beginning, after it has been cut to length, punched and rolled, as before described. The spokes are cut an exact length after having been rolled to a proper size, which is simply reducing oval stock for about half the length of the spoke to a round shape having an imperceptible taper. The small end is then heated and laid to protrude a certain distance beyond the jaws of a horizontal ram, while the other end rests against a gauge which fixes the length which the spoke shall be inside of the tire. Now the tire is laid on the machine in such a way that the hot end of the spoke enters the tire a distance which is also gauged (see Fig. 1), the ram is put in motion, and, as it moves forward, it locks the jaws firmly together upon the spoke retaining them, as it moves onward, and upsets a collar between the tire and the jaws inside of the tire, and at the same time rivets a set portion of the spoke on the outside of the tire (see Fig. 2).

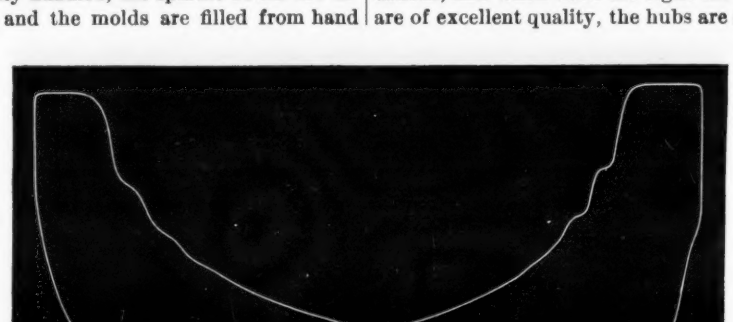
This is a very successful operation, and is in the nature of a novelty, "killing two birds with one stone," as the first plan of fastening the spokes into the tire was to form a shoulder on the spoke at a proper distance from the end at one operation, and to put it into the tire and rivet down the end at another operation. It is a question whether it is always more economical to kill two birds with one stone, or, by throwing quicker, kill two birds in less time with two stones.

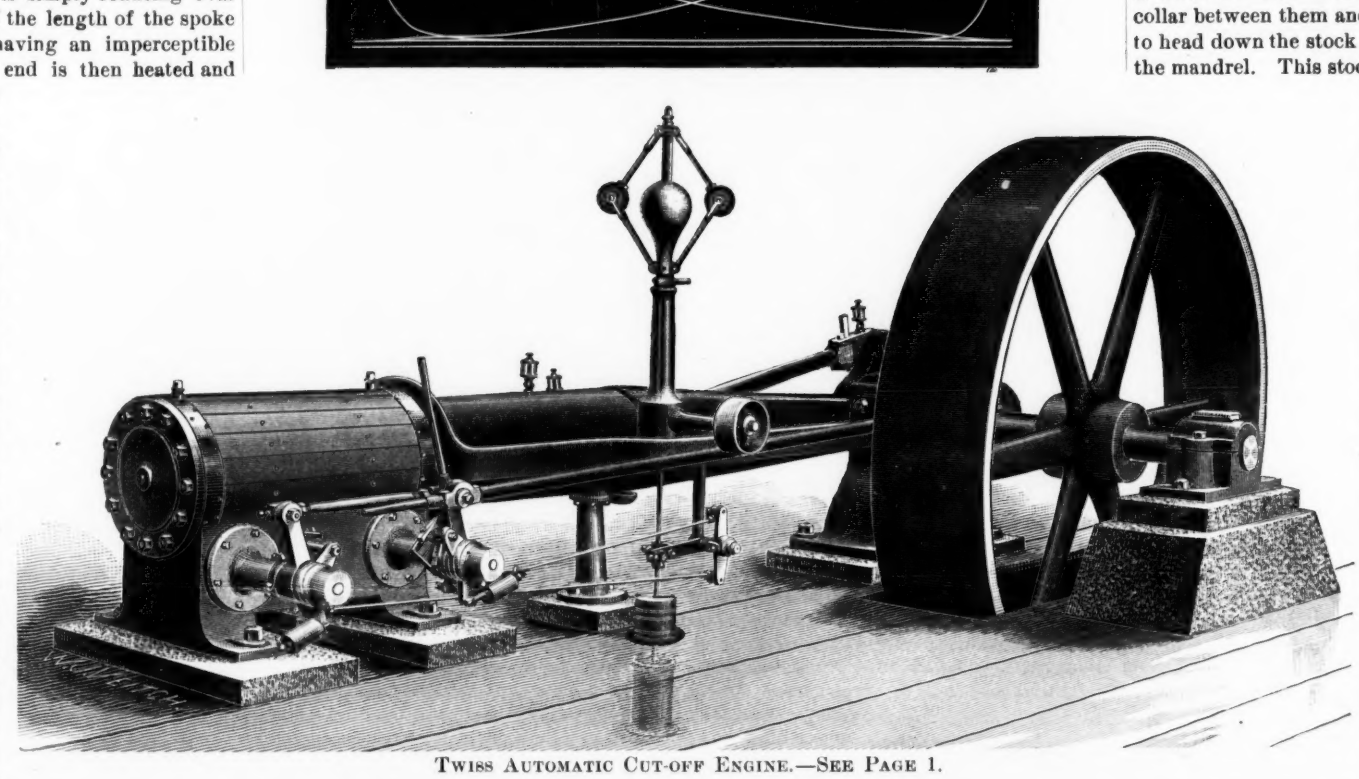
After the spokes are all set in the tire, the wheel is ready for the hub. At one time, the hubs of the wheels, from which the ones we are describing were evolved, were made of sheet-metal struck up in two halves, with recesses for receiving the spokes on the outer diameter, while the center bulged out into a hub shape, and the spokes having been inserted, these two halves were riveted together; the tire was put on, and the spindle box was driven in the center, which came in contact with the ends of the spokes and set them out, thus self-centering the wheel. After this, for the purpose of fastening the spokes tightly into their places, these hollow sheet-metal hub skins were filled, by pouring molten cast-iron into them, which ran all around the spokes and bound them securely in place. Occasionally a spoke would fail after the wheel was complete, and it was good economy to knock off the old hub, insert a new spoke, and then, by making a new hub, the wheel was as good as new. The difficulty experienced in knocking off the old hubs disclosed the fact that the cast-metal was strong enough for the hubs, without the sheet-metal coverings. It was then but a short step to supplant the sheet-metal molds with cast-iron molds which could be easily put on and removed, and which would give at all times the desired shape to the hubs.

This plan is now carried out in practice in a number of different establishments on a large scale. The hubless wheels are rolled into the foundry, and, when pouring time comes, the light and readily adjusted molds have been fixed on as many wheels as may be conveniently handled, the spindle boxes are inserted, and the molds are filled from hand ladles. The operation is continuous, the molds are taken off as soon as the metal sets, which is very quickly, and are then readjusted as before on other wheels. The metal poured in is not especially designed for this purpose, but is taken from the general run of metal used in making agricultural castings, and is stronger than the same metal poured in sand.

The hubs seldom crack from shrinkage around the spokes. They are very free from inperfection, such as cold shuts from sluggish running, and are very smooth, without scale. There is sometimes some curious behavior at the intersection of the spoke with the hub, caused by the difference in expansion between wrought and cast-metal. This varies in some measure with the variation of heat at which they are poured. It is possible, however, to produce nearly uniform conditions, and when these are right the wheels are of excellent quality, the hubs are strong, the spokes rest on the spindle boxes and are tight in their places. The cast-metal breaks with a tough looking fracture, and there are indications that its carbon exists more largely in a combined than in a graphitic state. Tried with a file, the degree of hardness is about that of a spring temper in old-fashioned steel.

Novel methods of making metal wheels are sought with eager avidity, for they become the foundation of new enterprises. The idea was conceived by one concern that if the work of inserting and securing the spokes could be done cold, instead of hot, there would be profitable saving of time, as well as of fuel. The plan, as it was finally adopted, required the preparation and welding of the tires as a first operation. The spokes were got out to the proper length without any collars or shoulders. The next operation was putting the spokes through the holes in the tire one after another, and fastening each into the hub before the next was put in. The hub was put over a mandrel in an upright ram, from which it was raised enough so that when the spoke passed through it, and rested on the mandrel, it protruded enough to form a head inside of the hub (see Fig. 3). When a spoke was in this position and the ram was started, a pair of jaws came together on the spoke at the proper distance above the hub, and gripped it so tight that it was held fast while they pressed downward with it hard enough to raise a collar between them and the hub, as well as to head down the stock between the hub and the mandrel. This stock was steel, and the uniformity which has been attained in these cheap grades of steel may be judged of from the fact that one pair of gripping dies, 6" long, is depended upon to stand without repairs to grip and upset 10,000 spokes. This is a gratifying advance, for it is but a few years ago when such a record could not have been made.





TWISS AUTOMATIC CUT-OFF ENGINE.—SEE PAGE 1.

But that there is some amount of variation in the steel is manifested by the fact that the spokes are not of uniform length after going through this process. The spokes now project through the tire, and the tire is too close to the end of the spoke to admit of cutting the spokes to a uniform length with shears, and the ends are therefore cut off with a pair of large cutting nippers, operated by power. When cut to a uniform length from the hub, they are taken to another upright ram which grips the spoke, inside the tire, in such a way that, when the ram has done its work, a shoulder has been raised on the spoke inside of the tire, and a head has been made on the outside, in the same manner as has already been described with spokes which had been heated. With an ingenious device for compensating for any slight irregularity in the size of the tire, the operation is successfully performed and makes a good wheel, which has the advantage of being susceptible to repairs, as broken spokes can be taken out and new ones sprung in. This is found to be quite practicable. If the cold flowage of the metal was produced rapidly, by a quick blow, it is quite probable that the changes of internal structure, suddenly occurring, would produce a condition which would make the metal easy to be broken, but when more time is allowed for it to distribute itself in the most natural arrangement, this tendency is in some degree avoided. It is so much avoided that there is practically very little trouble from this cause. It is probably safer to submit them to the natural variations of temperature as they come from the press, than it would be to raise their temperature, because the tire would heat first, and, expanding between the head and shoulder of the spoke, would give it an extra strain.

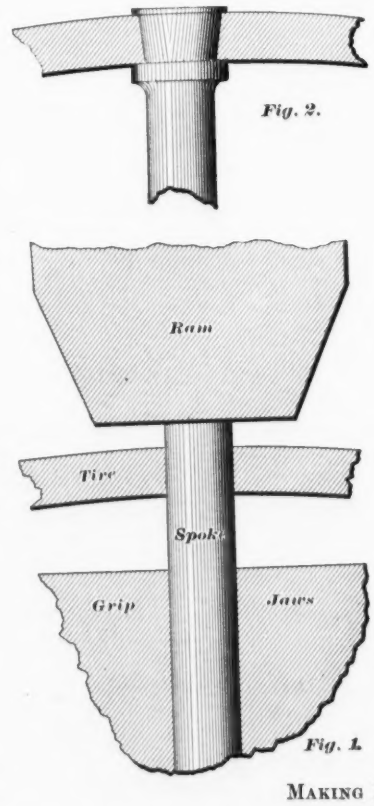


Fig. 1.

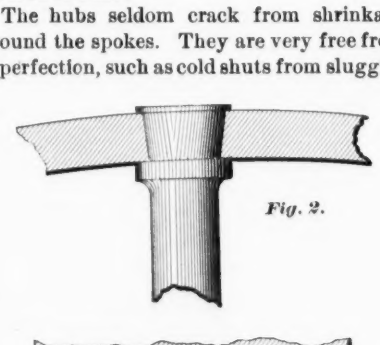


Fig. 2.

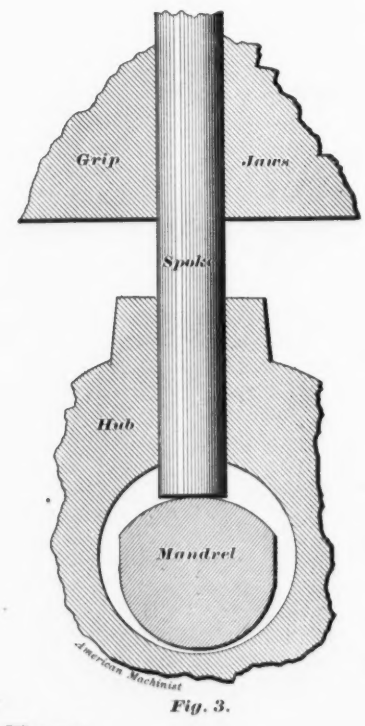


Fig. 3.

MAKING METAL WHEELS.

The latest scheme for getting coal from the Pennsylvania mines to New York is to reduce it to powder, mix it with water and pump it through pipe lines, delivering it into settling basins from which the dust is to be removed and made into bricks.

A strike of school teachers is rather out of the common in its way, but such a strike, against low salaries, is in progress at Fort Dodge, Iowa.

A Chapter on Machine Slides.

BY PROF. JOHN E. SWEET.

II.

In considering the question of long slides where one is from necessity much shorter than the guides, as is the case with the slide rest of a lathe, the word long is a relative one, and not one of feet and inches; for one of a given length is not always comparable to another of the same length; as, for example, assume a slide rest to be two feet long and guided by a single V in front, as near the driving power and work as possible, and the rest to run on a flat way at the back. Such a rest would run with practically the same freedom, whether the lathe bed was 1 foot or 20 feet wide, but if guided with either two Vs or made of the flat way style, with the guiding surfaces at the front and back, it would work quite satisfactorily when new with the bed one foot wide, but would not work at all on the 20-foot one. This is an extreme example, to show the necessity of getting the guiding surfaces within reasonable limits or close together, and is one of the advantages claimed for the single V guide over the flat bed. Admitting the advantage of bringing the guiding surfaces for a slide close together, the question may be asked, Why is not the plan suggested in the former article for guiding a shaper and milling machine knee a step in the wrong direction? On general principles it would be, but the knees are not usually working slides; that is to say, they are not slides that move under the strain of the cut, and the wear is insignificant, and besides, a slide 12″ between guiding surfaces, and 18″ long, is no better than one 14″ between and 21″ long, which is only what was suggested for the shaper knee.

Considering a change in such of the present machine tools as have slides guided on the plan of flat slides to lathes, Richards side planer, etc., bringing the guiding surfaces nearer together would be such a change as to make both guides at the front of a lathe. Should this be done, or when it is done, another question is opened for consideration, and that is, Where is the best point to apply the driving power?

The Richards side planer is a good example to illustrate the thought; see Fig. 6. If the guiding surfaces are brought together as at *a b*, and the driving screw retained in the position as shown, it will be seen that both the resistance of the cut and the friction on the slides are on the same side of the driving power, the two exerting a twisting force on the slide very much greater than if the screw was placed as shown in Fig. 7.

As will be seen, the frictional resistance of the slide is one side of the driving screw, and the resistance of cut on the other; hence, if the cut and friction were constant, and each a constant and proper distance from the screw, there would be a balance, and no twisting strain whatever. But none of these things are possible, and were they, instead of being a perfect arrangement, it would not do at all, as the chatter would be unendurable. Hence, while it is a move in the right direction to get the driving power between the guides and work, some judgment is necessary not to overdo it. I have used the Richards planer as an illustration, but not to suggest improvement. To resist wear as much as possible, the amount of wearing surface, sometimes its form (that is, whether long and narrow or wide and short), and its position, all need consideration. Take the crosshead of an engine when the pressure remains central, so far as easy running is concerned, it would make no difference whether wide and short or narrow and long; but in small engines, at least, when the length of crosshead approaches the stroke of the engine, long narrow surfaces would be best, provided the guides are short enough. To lengthen the slide is of but little use, unless the guides are shortened as well. In locating the position or direction of wearing surfaces, at right angles to the direction of strain is best, unless there is some reason to deviate from that, to prevent shake when looseness has resulted from wear. The wearing surfaces of the Vs for slide rest in a lathe are

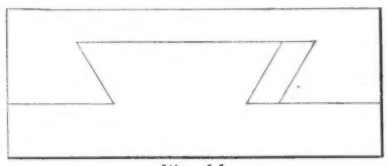


Fig. 11.

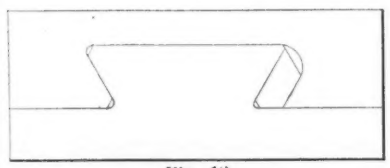


Fig. 12.

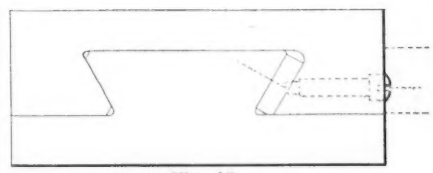


Fig. 10.

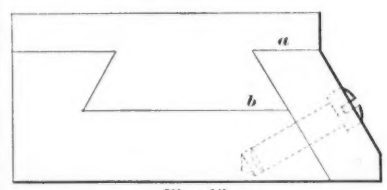


Fig. 13.

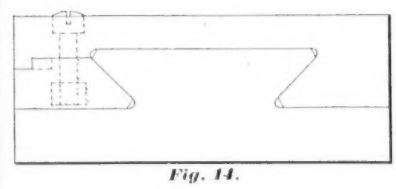


Fig. 14.

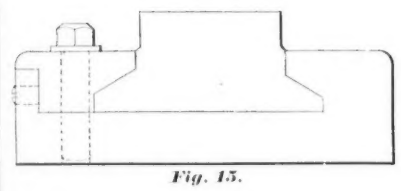


Fig. 15.

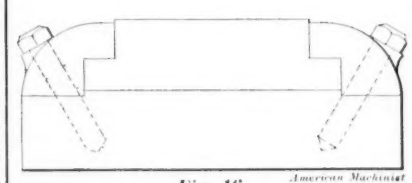


Fig. 16. American Machinist

is done in a proper way. Simply extending out in both directions long arms from an ordinary slide rest is of no avail, in fact, worse than useless, and for this reason: Assume the arms to be long enough and frail enough to spring, when the lathe is used for heavy cuts the center of the rest would spring down and the ends up, so that, instead of a long bearing, it would become a short one, wearing away in the center; then when light cuts were taken the rest would bear at the ends, and chatter would be the result. A long slide rest must be very rigid in the vertical direction, and casting the apron in the same piece is a good way to make it so.

As an illustration of the point that a small change will sometimes make a large difference in the result, see Figs. 8 and 9, which give two very common forms used for the cross-slides of lathes; each is represented as carrying a boring tool, with the assumption that the strain is in the direction indicated by the arrow. Assume the gib in each case to be loose, the strain will

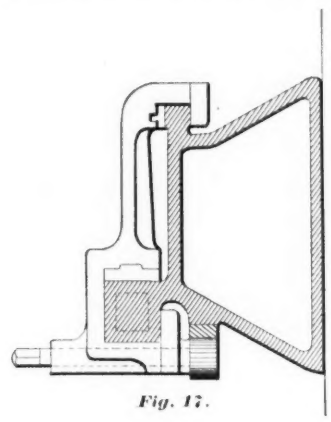


Fig. 17.

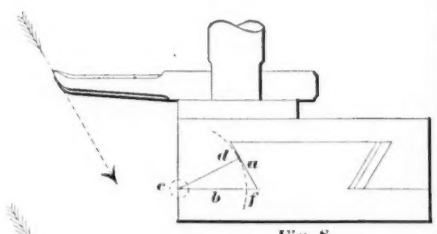


Fig. 8.

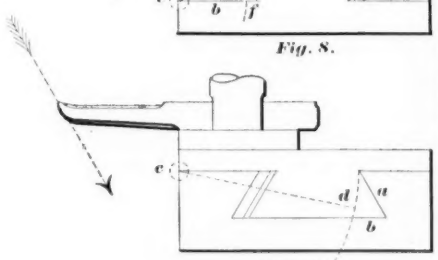


Fig. 9.

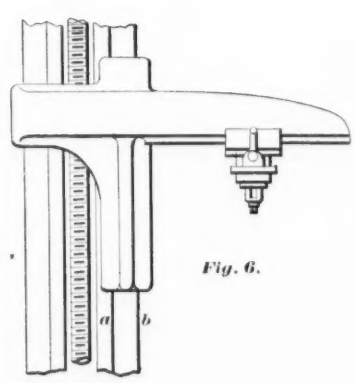


Fig. 6.

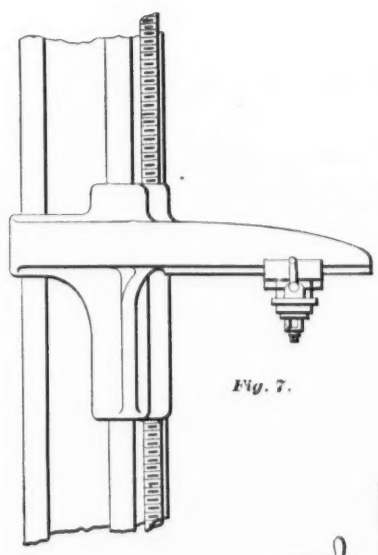
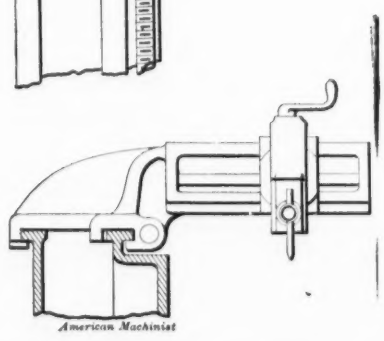


Fig. 7.



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not at right angles with the strain or pressure, but no lost motion results from wear.

In such a case, the best results can be obtained only by giving ample wearing surface, and this is best obtained by adding to both length and width of Vs, when that tend to force the two bearings *a* and *b* in contact, and to rotate each upper piece around the center *c*. It will be observed that in Fig. 8 the lower arm from *c* to *d* is very short, and the overhang of dovetail at *f* is very slight, whereas in Fig. 9 the lower arm is longer and the overhang is more. So it is safe to assume that, under the conditions indicated, a lathe made like Fig. 8 might chatter in boring holes, when one made like Fig. 9 would not. This is not given as a criticism on lathe slides, nor as an assumption that one way is right and the other wrong, but simply as an example of results that a little thinking may bring out.

Figs. 10 to 16 show various forms and methods of gibbing slides. Fig. 10 is given as an improvement on the common form; the sharp angles are rounded, the acute corners chamfered off, and the screw one side of the center, or so a line at right angles with the wearing surface and central will strike the center of screw point.

Fig. 11 shows a common form when the gib is a wedge, and wear is compensated for by moving it endwise. As usually made, these gibs weaken the guides more than necessary, as the form shown in Fig. 12 gives the proper bearing to gib, and leaves the casting stronger.

Fig. 13, Warner & Swasey's gib, is simple and rigid. It has the merit of not belonging to the take-up-to-day-and-let-out-to-morrow sort, but is one that is good until it wears too loose, and then when it is refitted it is as good as new; that is, unless when it is refitted the gib falls away from the joint at *a*, and so transfers the support to *b*, which is not as good.

Fig. 14, Giles Graham's form, has its angles at 45°; the gib takes up wear by being moved endwise, is rigid and simple.

Fig. 15, very like Bement & Miles shaper ram, has its main take-up sideways. If the wear was equal upward and sideways, the gib would not take up except by refitting.

Fig. 16, shaper slide with Armstrong's gibs—a rigid form; the wear taken up like Warner & Swasey's, by scraping away the gib seat; with this the alignment can be maintained, and the fit kept up in both directions.

Fig. 17 shows a form for crosshead and slide for vertical spindle machines, which the writer believes to be better than the ordinary kind. The principal work of guiding the slide is done by a long slide at the bottom, and as near the driving power as possible. The vertical position of the spindle is maintained by the upper guide, and the two gibs give an adjustment that permits of maintaining the spindle perfectly vertical—an essential feature in a machine of this character.

Efficiency of Locomotives.

BY J. J. FLATHER.

In a recent issue of the AMERICAN MACHINIST (February 18th), your correspondent Mr. W. H. Booth, in his discussion of English and American locomotives, states that "it would conduce immensely to the value of the locomotive discussion if we would all of us go no further back than a draw-bar dynamometer, and use the indicators on the cylinders. We could then simply refer the power developed to those responsible for the design of cars and track. Knowing the horse-power exactly, as we could do if we used a continuous indicator—self-recording—it would be easy to refer to the water consumed, and fuel."

The comparative efficiency of two locomotives, whether English and American or otherwise, will always be an unsatisfactory question when referred to train performance.

Builders of stationary engines rate their engines from cylinder capacity with assumed cut-offs, and mean effective steam pressures for a given piston speed, but if a comparison of efficiencies between two engines is to be made the cylinder capacity is not the governing factor—the quantity and pressure of steam used, and the actual horse-power transmitted, now constitute the data for comparison. If the respective boilers are included in the tests for efficiency the question becomes simply which engine (with boiler) will develop the greater horse-

power per pound of coal, or per 1,000 heat units, if the quality of coal is known. We are not considering economy, but efficiency. Economy, as pointed out by Prof. Woods lately, is a question of dollars and cents, involving local considerations, such as cost of fuel, water, attendance, lubrication, wear and tear, and repairs. The actual available horse-power of an engine is not the horse-power developed in the cylinders, but is that transmitted through the shaft. To obtain this available horse-power some form of friction brake or dynamometer is used by which the power is measured at the shaft. The brake horse-power plus the friction in the engine equals the total horse-power developed in the cylinder, and this brake horse-power is that value which should be used in comparing one engine with another.

In the locomotive discussions which have been continued for some time past in our engineering papers, there seems little ground for comparison of efficiencies when the performances and conditions are so widely variant. Two locomotives drawing the same number of cars, loaded or empty, as the case may be, and burning so many pounds of fuel per hour, or per mile, offer no reliable means of comparison; size of truck wheels, condition of wearing surfaces, construction of car, friction of brake shoes, which may be inadvertently left on, condition of track, and grade, and speed of train, all these affect the resistance of the train, and demand more steam, and, consequently, fuel.

Without considering these conditions, one locomotive may appear at great disadvantage when compared with another, and yet the efficiency of the former may be greater than that of the latter.

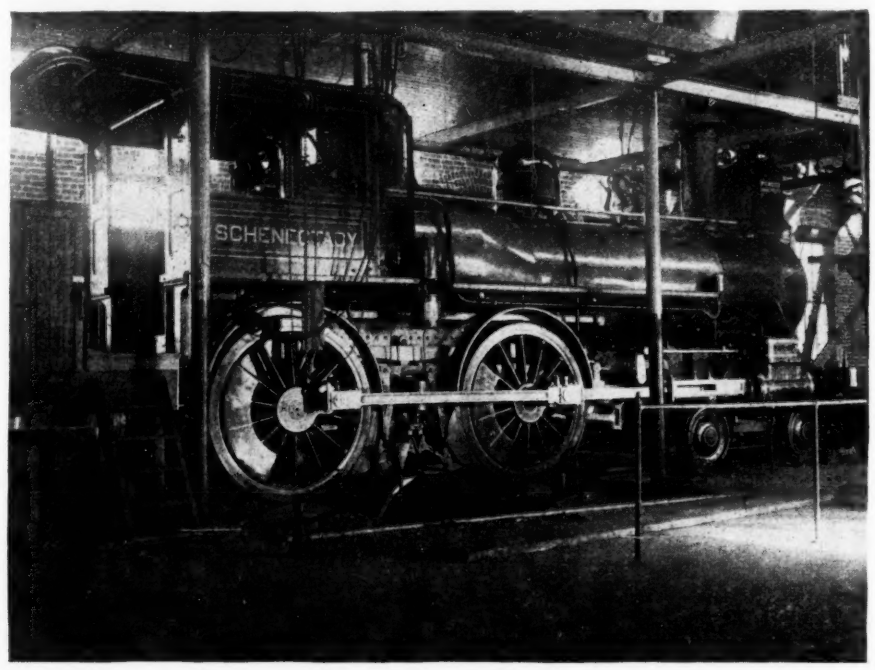
What is desired is the relative load which an engine can pull under given conditions of fuel consumption and speed. Relative efficiencies of track and rolling stock should not enter the discussion, any more than that we should consider the friction of shafting in a factory when comparing the efficiency of stationary engines.

A record of the horse-power developed in the cylinders, together with a register of the pull of the locomotive draw-bar, would, as suggested by Mr. Booth, present more reliable data for comparison. To meet some of the questions involved, an eight-wheeled passenger locomotive has been fitted up in the experimental laboratory of Purdue University, by which the pull (or push) of the locomotive can be weighed while the power is absorbed by heavy friction brakes. The brakes used are a modification of the Alden dynamometer described in the AMERICAN MACHINIST of December 11th, 1890.

The locomotive, which weighs forty-three tons, is mounted as shown in figure, with its drivers upon heavy supporting wheels, free to revolve in either direction by contact with the drivers; the prolonged axles of the supporting wheels are each provided with a large cast iron disk, keyed to the shaft, which is allowed to rotate in a closed case between two thin plates of copper, which plates can be forced against the rotating disk by hydraulic pressure, as in the Alden brake. Each brake was designed for a load of 200 horse-power, with a maximum water pressure of 40 pounds per square inch under a moment of 10,500 foot-pounds. The shaft to which the disk is keyed is 7¼ inches in diameter. The disk is 56 inches diameter and 2¼ inches thick; it is provided with suitable oil grooves on each face, by which the lubricating oil which enters at the hub is constantly circulated, thus allowing a thorough distribution of the oil to be maintained over the rubbing surfaces.

The locomotive is free to move forward or backward only through a very small distance (about a quarter of an inch), its tendency to forward motion being measured by a dynamometer consisting of a system of levers and weights connected to the draw-bar, by which the traction of the engine can readily be weighed. Any desired load and speed can be maintained by means of the powerful friction brakes which are bolted securely to stone foundations—in this respect differing from the Alden dynamometer, which is free to rotate through a small arc.

The boiler may be fired with coal in the usual manner: provision is also made to supply steam from an auxiliary boiler if desired. Each cylinder is fitted with a pair of indicators and suitable rigging for taking cards. A large Sturtevant fan, actuated by an independent steam engine, is placed above the locomotive smoke-stack, but not in connection with it, and takes up and carries off through the roof whatever would otherwise be discharged into the building.

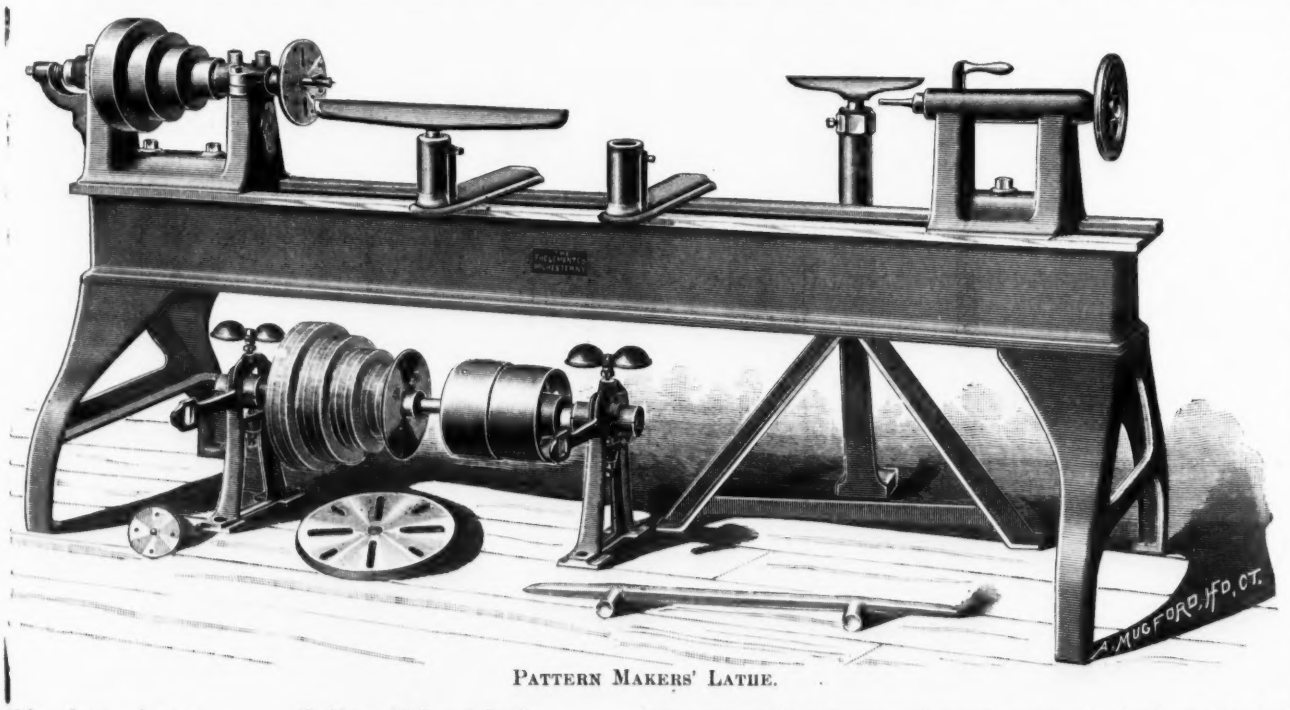


EFFICIENCY OF LOCOMOTIVES.—SEE PAGE 3.

Pattern Makers' Lathe.

We illustrate herewith a pattern makers' lathe, which, in accordance with modern demands in such machinery, is made entirely of iron and steel, the bed being planed up true, and, when desired, furnished with a carriage which is moved by hand-crank and rack and pinion.

The spindle is of steel running in babbitted boxes scraped to a bearing. It has the usual left-hand thread at the rear, to which a face-plate is attached for work larger in diameter than can be swung over the bed, a substantial floor rest being provided for such work. There is a detachable yoke which can be placed at either end of the spindle to take the end thrust, this being provided with a bronze step and hardened steel center pin. Head-stock cone-pulley is made as light as possible and can be reversed in the head, so as to bring the large step to the front if desired. The countershaft cone is of cherry, kiln-dried, glued up in strips and finished in shellac. The lathe is built by the Frank H. Clement Co., Rochester, N. Y.



PATTERN MAKERS' LATHE.

Wind Power Utilization—Trade Catalogues.

BY W. H. BOOTH.

I have seen to-day a method of utilizing wind power, which is to me novel.

Americans who have traveled in Holland well know the form which is taken by the old world style of windmill. The sail is a huge affair of perhaps sixty feet diameter, with usually four ponderous arms, though in England windmills with five and six arms are not infrequent, and sometimes two arms only may be seen.

I believe, too, that the old style of mill is to be seen in Canada, where it takes a look of age quite equal to any Dutch drawing of a mill. Cervantes describes Don Quixote as charging a battery of windmills, and one might almost suspect the picture to be over-drawn. I have, however, seen fifteen or more mills standing in a row upon a hill in Portugal somewhere near Cintra, and in full view from the ocean, whilst near to them was a row of several others.

Until the introduction of the American mill, with its annular sail and numerous laths, the only windmills in England were of the old, or, as I call it, the Dutch type. Now, however, there are a large number of the smaller American mills to be seen.

There is one in London perched high up on a timber tower erected on the top of a building on the City Road, not far outside the old "City" boundary. It has a sail of thirty feet diameter, and is quite a big affair when one climbs to the top of the tower. But what I especially wanted to note was the fact that this windmill is lighting the premises over which it stands.

Its upright shaft, which comes down from the mill, drives a horizontal shaft which carries a large belt pulley, and by this large pulley is driven a small dynamo. The dynamo generates current which charges a battery of accumulator cells, and these in turn "drive" the lamps. At times, of course, when the wind is low, the speed falls below what is proper for the charging of the secondary battery. To prevent this being charged at such low speeds there is a cut-out held in by a magnet, and kept out by a coiled spring.

When the magnet is weak the current is cut off from the accumulators, but when the dynamo is running at a fair speed the magnet is strong, and pulls the switch into contact and the charging proceeds. The mill will run and charge all night and all day, and is acting very satisfactorily. Of course in quiet weather it runs much of its time slowly, and therefore uselessly, but it also runs the night through, and I suppose would, on an average, do eight hours work in twenty-four, which is used by some as nature's argument in favor of an eight hours' day. The man who owns the mill has got his name very prominently upon the director fan of the mill or wind vane, and an attempt has been made to bring it in under the sky sign regulations; but it has been held that a windmill is not a sky sign, but a useful institution, which the common or garden variety of sky sign certainly is not, and so the miller has got his sky sign after all.

Makers of American windmills ought to take note of this fact, and turn their attention to the manufacture of a windmill which, while serving a useful purpose as a generator of electric light, will wave its owner's name and his particular productions before the eyes of a city. There are those unkind enough to suggest that the dynamo and accumulators are only so much blind to cover the sky sign, but I don't believe this, for the whole installation is too neat and complete, and for the purposes of a blind the owner would scarcely go to the expense of a really good dynamo and a lot of cells, when he might have arranged something at a less cost, as, for example, a timber nutmeg lathe which would have better met the eternal fitness of things.

Anyhow this electric installation is a matter of interest, and well worth a visit. This is the first example which has come under my notice of electric light production by wind power, the uncertainty of which is usually held to debar it from so many useful avenues of work.

Respecting the writing for trade catalogues, etc., on plain paper, there are scores of cases where this is done, and trade re-

sults. Many men collect catalogues and have them for reference, and perhaps do not send an order for years. Other men do a lot of work at home, and perhaps run out of business paper. A few days ago I made an inquiry for a friend upon plain paper from people who I believed knew me. In reply they wrote a fussy letter, declined to quote a price until I had told them this, that and the other which they did not need to know, and so wasted my time that I inquired also in another direction, and the chances are this other man will get the benefit. It sometimes pays to be civil to very small men, an example of the advantage of which I recently encountered.

A young engineer applied for a berth to a large engineering firm, and was treated with that scant courtesy which often is dealt out to those so unlucky as to need to seek employment.

Before many weeks had passed a turn in the young engineer's affairs sent him to that very shop as an inspector for a foreign government who had machinery under construction there.

In writing for catalogues one cannot always be certain that they will be worth even a post card. Too many are the poorest examples of printing, on poor paper, and of either too limp a construction to stand up on a shelf or else too wide from back to front to allow the door to be closed.

In respect of excellence in form and size some American catalogues take the lead, as well as in their internal arrangements, and I have several such always in reach.

When an engineer goes abroad he naturally writes round for all the papers bearing upon work which he may have to carry out, and one never knows when he may not send an inquiry.

Firms who have been long in business know well that when they have changed their name slightly they will continue for years to receive inquiries and orders under their former name, which, in not a few cases, is due to old price lists and catalogues.

Quite recently I know of a first inquiry having gone to America as the result of the possession of a catalogue for four years unused before.

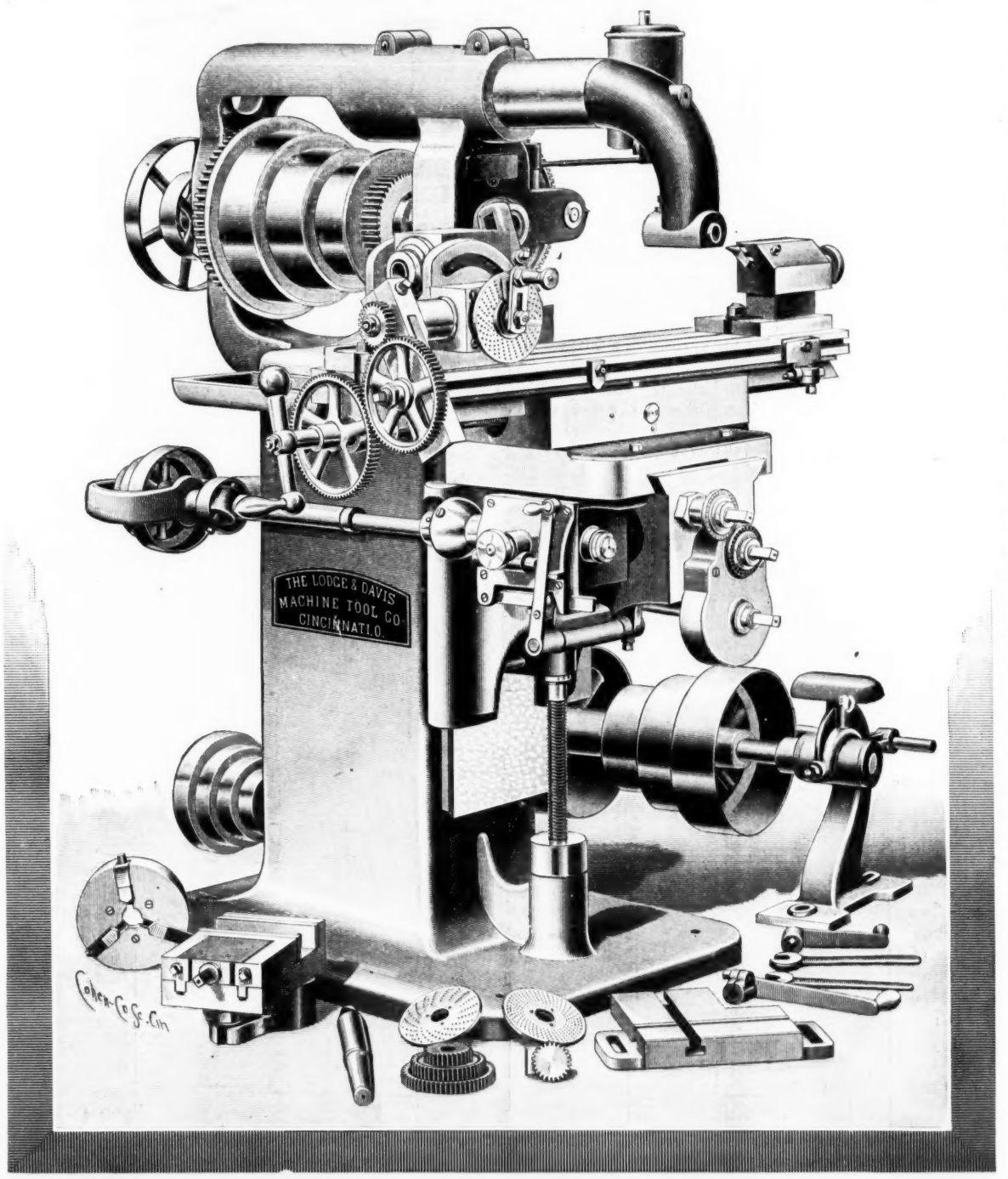
Transmission of power by electricity appears to be gaining friends in Sweden, although the installations hitherto completed are somewhat modest in their scope. They have, however, given satisfaction. At the Vesteras Engineering Company this system has been used for about a year and a half, entailing a decided reduction in working expenses and wear and tear, besides being exceedingly reliable. At Skutskar saw-mills a small accumulator locomotive has done good work.

The Kempsmith Improved Universal Milling Machine.

In a former issue, we have given a description of this machine, as made and sold by the Kempsmith Machine Tool Co. We now present an engraving showing the improved machine still made in the same shops, but sold by the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio.

Its distinctive features may be reviewed briefly as follows: The two uprights are connected by an arch, which is bored to receive the overhanging arm, the bearing being 12" long and provided with two clamping screws; cone pulley is placed with the small end to the front, to allow of better bracing of the main bearing; there are six changes of feed, and the feed is automatically tripped at any point when running in either direction, the design of the mechanism being such that the trip of feed is as easy when under full cut as when not cutting at all. For ordinary spirals the change gears are not compounded, but are simple, so that the gears are as easily changed as those of a lathe, while the range of spirals is ample for most purposes. Compound gears are used when unusual spirals ranging from one turn in $1\frac{1}{8}$" to one turn in $133\frac{1}{8}$" are to be cut. The foot-stock center is set off at one side of the block as well as at the top, so that cutters can be run very close to the center either at the top or at the side, which in many cases obviates the necessity for using small stem cutters.

There is a fast and a slow motion for the knee, both being graduated. All the usual functions of a universal milling machine are performed by this one, and it is especially designed for taking heavy cuts without jar or vibration, and for doing the best of work. All the attachments shown in the engraving go with the machine.



THE KEMPSMITH IMPROVED UNIVERSAL MILLING MACHINE.

The President has approved an act to protect foreign exhibitors at the World's Columbian Exposition from prosecution for exhibiting wares protected by American patents and trade marks.

The Delaware, Lackawanna & Western Railroad Company will replace all its wooden bridges on the Morris & Essex division with iron ones.

Compound Engines.

BY JAMES TRIBE.

SEVENTH PAPER.

HORSE POWER AS A STANDARD MEASUREMENT OF WORK PERFORMED IN A STEAM ENGINE.

No attempt will be made in this paper to fully discuss the subject of work, but simply to touch upon it sufficiently to show how it is capable of being measured by what is universally known in steam engine practice as a horse-power. To get an intelligent understanding of what is meant by this standard measurement, it may be found helpful to consider it in the following way:

MECHANICAL FORCE OR PRESSURE.

Newton's first law of motion reads: "Every body continues in its state of rest or uniform motion in a straight line, except in so far as it may be compelled by impressed forces to change that state."

All work performed in a steam engine is done at an expenditure of heat. This heat is produced by the consumption of fuel, such as coal, wood, oil, gas, etc., which heat, when produced, being imparted to water, raises the temperature of those particles of water nearest in contact until they take the form of gas, when they immediately rise toward the surface, and so make room for other cooler particles to descend and take their place, which in turn are also heated and rise toward the surface in like manner.

The height to which these particles of heated gas will rise is dependent upon two things, viz., the temperature of the water surrounding them and the pressure upon the surface above, the first condition constantly changing as more heat is applied, until the heated particles are able to reach the surface and pass off in the form of gas known as steam.

To bring these heated globules of gas up to the surface of the water they must exert a certain mechanical force sufficient to overcome the surface pressure opposing them; therefore the greater the surface pressure the greater must be the mechanical force of the steam necessary to overcome it, and consequently a higher temperature is necessary to produce that force. As a matter of fact, if water is heated in an open vessel and subject to the atmospheric pressure of 14.7 pounds per square inch, the temperature of both water and steam at the surface must be equal to and can be neither more nor less than 212 degrees, when the water is said to boil. Should the vessel be inclosed and connected to an air-pump, and the air exhausted forming a partial vacuum, the pressure upon the surface of the water being thereby reduced, steam will be generated at a corresponding lower pressure and temperature. Although a perfect vacuum is impossible, the air may be so far exhausted as to reduce the pressure per square inch to possibly 13.7 pounds below the atmosphere, or one pound absolute; but if the surface pressure be increased the temperature and force will likewise be correspondingly increased.

By reference to a table on properties of steam, it will be seen that for one pound, absolute pressure, steam is generated at a temperature of 102 degrees, while at a pressure of 175 pounds absolute the temperature equals 370 degrees.

FORCE AND RESISTANCE.

Force and resistance, when equal to each other, and acting upon opposite sides of a body, will not move it from its state of rest; but whatever force may be exerted upon that body to move it through space at any velocity must be opposed by an opposite resistance, or sum of resistances, which shall exactly equal the force applied in imparting movement to it, before it can be brought to rest again. This resistance may be entirely due to the friction of a machine, or in part due to friction and part to the useful product of that machine. Such is true of the steam engine, wherein the effective force exerted upon the piston by the pressure of the steam sufficiently to impart to it certain momentum, must sooner or later find an equal and opposite resistance before it can be brought to rest again; but so long as the effective force is maintained, just so long will the machine be capable of producing useful results.

Force and resistance as considered in a compound steam engine assume three forms, viz., forward pressure, back pressure and effective pressure. Forward pressure is that force which is exerted upon one side of a piston, tending to move it in the direction for performing useful work. Back pressure is a force acting upon the opposite side of the same piston in resistance to the forward pressure, and effective pressure is the difference between the forward and backward pressure, or the measure of force by which the forward pressure predominates over the backward. For illustration, steam at the atmospheric pressure when admitted to one side of a piston can perform no work

or exert no useful force, except in so far as the atmosphere is removed from the opposite side. Likewise in a compound engine, where two or more cylinders are employed, the first receiving steam direct from the boilers, and exhausting it into a receiver ready to supply the next cylinder. No work whatever can be done on the first cylinder unless the steam is cut off before the piston reaches the end of its stroke, and so be allowed to expand to a lower pressure before exhausting, for the reason that if the receiver pressure is equal to the terminal pressure in the first cylinder (which is desirable), the resistance would be equal to the force, and the one would counteract the other; consequently the first cylinder would be of no value whatever; but where the steam is made to expand from a higher initial pressure to a lower terminal pressure, the mean or average force or pressure produced thereby is opposed only by a resistance equal to the terminal or receiver pressure, and that being less than the average forward pressure, leaves an effective force capable of performing useful work upon the first piston.

WORK.

Mechanical force or pressure without velocity is not work; but when a pressure is exerted upon a body, which causes it to move through space, then that pressure, multiplied by the space passed through in a given time, is regarded as work. Work performed upon the piston of a steam engine can only be calculated upon the consideration of three fundamental elements, viz., effective area of piston in square inches, mean effective pressure in pounds upon each square inch of the effective area, and the distance in feet through which the piston moves in one minute.

FOOT-POUND.

If we regard the standard foot as a unit of space, and the standard pound as the unit of pressure, then a unit of work is one foot multiplied by one pound, and is expressed as one foot-pound; or ten pounds exerted and maintained through ten feet, then the work done would be $10 \times 10 = 100$ foot-pounds, and so on.

ONE HORSE-POWER.

It is explained above that one pound pressure moving a body through a distance of one foot is regarded as one foot-pound. Now the work done upon the piston of a steam engine is the average pressure of steam exerted upon it, and causing the same to move through a certain distance; but unless the time occupied in passing through that space is taken into account no definite idea can be expressed to indicate the capacity of the agent employed.

Watt therefore established a standard measurement by which the work performed might be expressed, and as the result of some experiments made with powerful horses, he concluded that one horse was capable of performing 33,000 foot-pounds of work in one minute, which he called "one horse-power," and which has since that time been almost universally accepted as such. Therefore "a quantity of work equivalent to the raising of 33,000 pounds, through one foot of space, in one minute, is established as one horse-power."

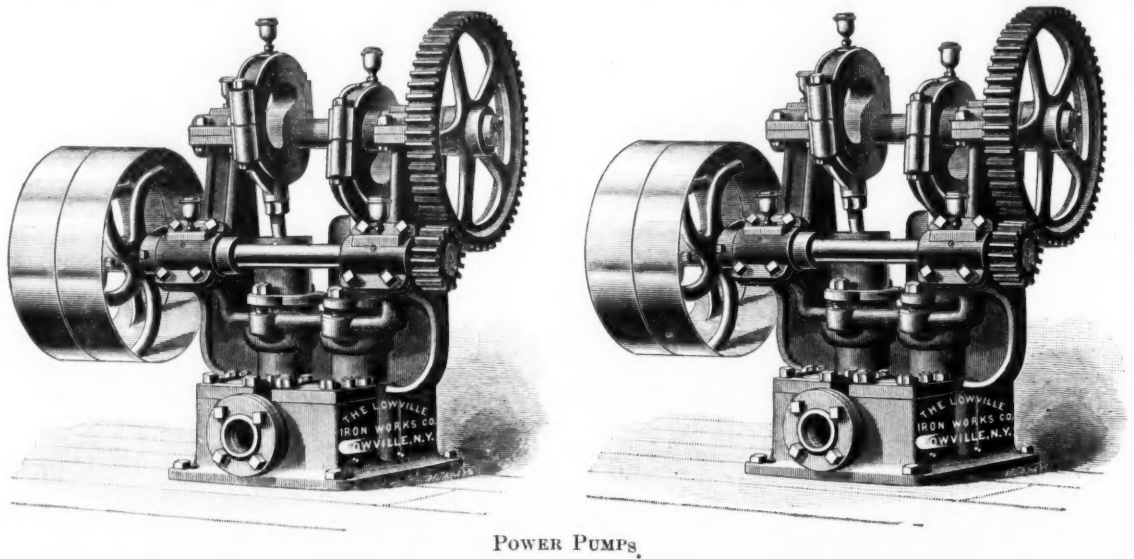
Of a party of eighty mill operatives who left England last August for Brazil, four have recently returned being the sole survivors of the party. They were assisted in getting transportation home by British residents in Rio Janeiro.

The Imperial Railways of North China have placed an order for 6,200 tons of rails and 750 tons of accessories, which will be supplied by Messrs. Bolling & Lowe, of London. On a former occasion a German maker obtained a similar contract.

Power Pumps.

The engravings herewith presented represent a line of belt-driven pumps now being manufactured by the Lowville Iron Works Co., Lowville, N. Y. They are built both duplex and triplex, as shown; simplicity, convenience of access, and strength for the heaviest pressures being kept in view in their design. All studs, bolts, nuts, etc., are standard, so that they may be replaced with the greatest facility, and there is provision for taking up wear at all points where wear can take place. The eccentric straps are lined with hard babbitt, which is so disposed that the iron of the straps cannot come into contact with the eccentrics until the babbitt is entirely worn out, thus greatly lessening the liability of the eccentrics being injured by neglect. The boxes are also babbitted, and both boxes and eccentric straps are scraped to a fit. The connecting rods are wrought-iron forgings. All valves can be removed or replaced without breaking a pipe connection. Gears are proportioned 4 to 1 or 6 to 1, according to size of pump, but where the pumps are to be used for circulating tanks, air-pumps or other purposes requiring comparatively light pressures, the gears are not used, but instead the pulley is keyed direct to the eccentric shaft.

A very steady pressure can be maintained, by the triplex pump especially, the eccentrics being set at equal angular distances from each other, so that one of them is always working. They have been used for maintaining a water pressure for feeding stock to wood pulp grinding machines, where a steady and uniform pressure is of great importance, and have given satisfaction for the service. The smaller size of duplex pumps are especially for boiler feeding. The duplex pump is made in three and the triplex in four sizes.



POWER PUMPS.

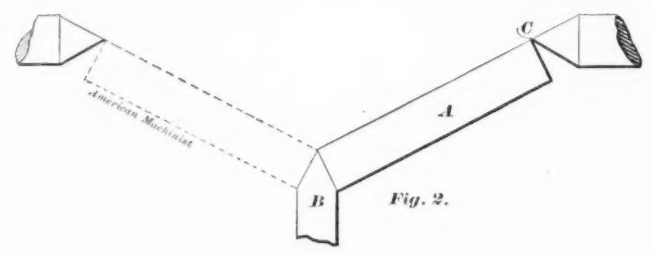


Fig. 2.

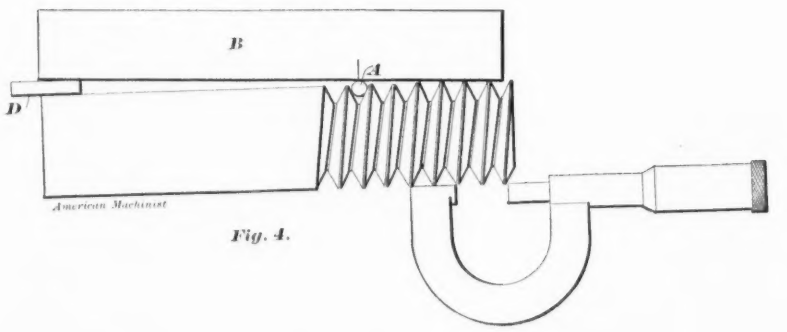


Fig. 4.

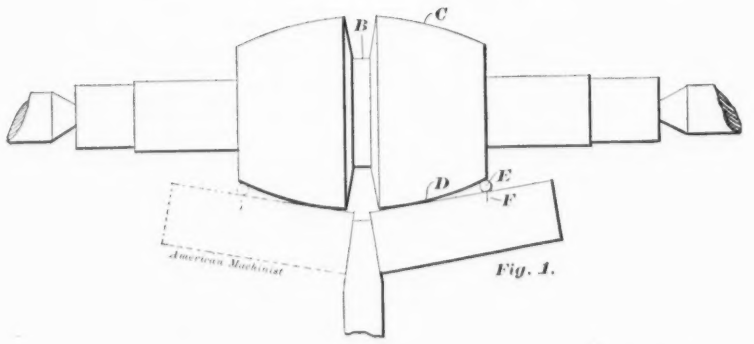


Fig. 1.

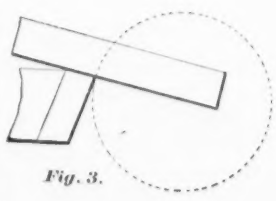


Fig. 3.

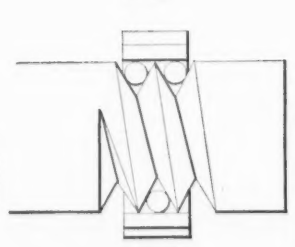


Fig. 5.

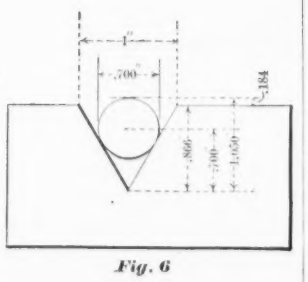


Fig. 6

SCREW CUTTING.

LETTERS FROM PRACTICAL MEN.

Screw Cutting.

Editor American Machinist:

I have a little to say about setting tools for screw cutting, and in measuring correctly the diameter of screws.

A very simple and accurate way of setting a thread tool square with line of centers is shown in Fig. 2. I do not mean better than a thread gauge, but for a special form of tool when there is no gauge to fit. I use a common steel scale, as at *A*, one end resting along edge of tool (*B*) with the inside edge just flush with point of tool, the other end extending to the lathe center, so that the corner will correspond with point of center, then I change the scale to the other side of tool, as in dotted outline, and see if it corresponds with the other center as before; if so, the tool is set about right.

When I have a piece of work on centers that is long and straight enough to admit of it, I use the scale to indicate upon the work, instead of the centers of lathe.

I have used this plan in a case like Fig. 1, in which it was wanted to cut the groove *B* in the piece *C*, so that a line drawn through the center of groove would be radial with the circle *D*. The ends were not squared up central, but just merely "squared." I used a scale, as in Fig. 2, but here in combination with a small plug *E*. I hold the end of scale against edge of tool, as shown, and bring the side in contact with work, then I insert the plug into the wedge-shaped opening, and notice at what line on scale it stops, as at *F*, then if it goes to the same place when the scale is held in the same way, at the opposite side of tool, the tool points to the center. I had, of course, first to set the tool in line with cross-slide, as in Fig. 2. I have seen machinists who were very careful in grinding a V thread tool, so as just to fit the gauge when held parallel with top of tool, then set the point level with lathe center, and imagine it was set just correct, when really it was not even somewhere near correct, because the top of tool had either an up or down rake, as in Fig. 3. When a tool is ground as in Fig. 3 it can be set so as to cut the right angle, if instead of setting it level with center, it is set with a scale or straightedge so the top of tool (when half the diameter of work from center) is radial, as in Fig. 3. I have found it an advantage on some old worn-out lathes to grind and set a thread tool in this way, for the pressure of cut is in two directions, which will at the same time hold the slide down and back.

In measuring the diameter of a screw correctly, the thread micrometer or vernier with the special V and point to fit is a useful tool, but when we do not have such a tool, and want to measure a screw correctly, we can do it just the same if we know how.

In Fig. 4 I show two plans I have used for gauging the depth of U. S. Standard threads. One is to compare one being cut with one of same pitch that is used for reference.

I use a steel scale *B* and a little plug *A*, which I cut from Stubbs wire, placing the plug into thread of screw I am using for reference; I file the plug flat, so that when one end of scale is held in contact with work, and point *C* is resting upon plug, a piece of tissue paper will just be pinched under the other end of scale, as at *D*. In my sketch, *D* is a pretty thick piece of tissue paper, but I only use this to give the idea. When I cut my screw so that the same scale, paper and plug will fit it in just the same way, I feel quite sure that the depth of thread is the same.

Another way of gauging the depth without a screw for reference was shown me by a friend, and in trying it I was disappointed, for I had no idea that such a little variation

Mr. R. Walters, lately located at Springfield, Ill., has accepted a position as superintendent with the National Electric Mfg. Co., Eau Claire, Wis.

could be detected in this way. A micrometer caliper, with square measuring surfaces, as shown in Fig. 4, is needed, which he sets any number of pitches plus ½ of one pitch, and compared it as shown, with the screw being cut, with the help of a glass. In Fig. 5 I show a way of measuring the diameter of a screw instead of just the depths of thread. A round plug will drop into a 60° angle just its diameter from point of angle to center of plug. Then a plug that is in diameter just ⅜ the depth of thread will lie into that thread "flush." We can take three of these plugs and use them as in Fig. 5 by measuring over all with a snap gauge of the size of screw required, or we can use plugs larger in diameter, and file one side of each flat. The amount to be filed off will be 1½ diameter of plug less depth of thread, or, instead of filing the plugs, add twice this amount to the diameter of screw wanted, then make the whole thing measure over plugs that amount. Fig. 6 I believe will make this matter plain. A U. S. Standard thread can be measured in this way by making allowance for the flat top. It is a good thing to know about all of these things, for there may be times when we shall want to use them, but when anybody says that no *tap* is correct unless it is measured in some such way, I believe they are way off, for a tap will most always go out of pitch in hardening enough to make a matter of two or three thousandths in diameter look very small.

A MECHANIC.

Catalogues.

Editor American Machinist:

I have read with interest the various views on the catalogue question, and was about to have postal cards printed to send to manufacturers as follows:

"10,000 catalogues wanted to classify and have bound for use in my office."

It was the intention of the writer to procure catalogues of every class of machines, tools, etc., and arrange them in classes, and have them bound. Much time could be saved in looking up any matter or machine, say if we wished to buy a steam pump, we would take that volume which would contain every manufacturer's catalogue of steam pumps, and it would make an easy job of it.

Now in place of having postal cards printed I will issue this invitation to any and all to send me their latest catalogues, and I will make a mechanical library that will be a joy to have.

C. M. COLLINS, M. E.,
Studebaker Bros. Mfg. Co.
117 E. Tutt St., South Bend, Ind.

The Catalogue Question.

Editor American Machinist:

There has been considerable said about sending catalogues. Some think they cannot send them unless they are requested on paper with regular letter-heads. This is the class of people that send catalogues, etc., to regular firms, and the wrappers in 90 per cent. of cases are never removed, but the whole thing goes to the waste basket and the rag man, or to make steam. There are tons of advertising material that accomplish nothing else and are a nuisance in the mails, in the office receiving them, and to everyone that handles them. They would be much more valuable if sent to boys, as they would give them an idea of what was being done in the world, and the chance of their being preserved and brought out at some opportune moment, and securing a purchaser, would be much greater.

There are times when our firm get to talking of putting in something new, and I am directed to write for descriptions and prices on plain paper, and without in any way bringing the name of the firm in. Of course prices obtained are subject to modifications, but they give us an idea whether we would be warranted in making the outlay, and, if not, it saves the firms responding the expense of sending a man to see if they could not in some way induce us to make a purchase that we had fully decided not to make.

I am pleased to say that such inquiries are usually received with courtesy, and the information cheerfully furnished. All of these catalogues are preserved for future reference, and possibly in the future may induce a purchase. They are not kept in the office, as there is no room there for such things, but are kept by the departments that require such goods.

Some people have a sort of mania for collecting catalogues, and in time become a sort of directory, and when one wants to find what there is in the market, a consultation of this collection becomes valuable to both buyer and seller. In advertising, as in all things else, you ofttimes "entertain angels unawares." W. E. CRANE, Chief Eng.,

BENEDICT AND BURNHAM MFG. CO.
Waterbury, Conn.

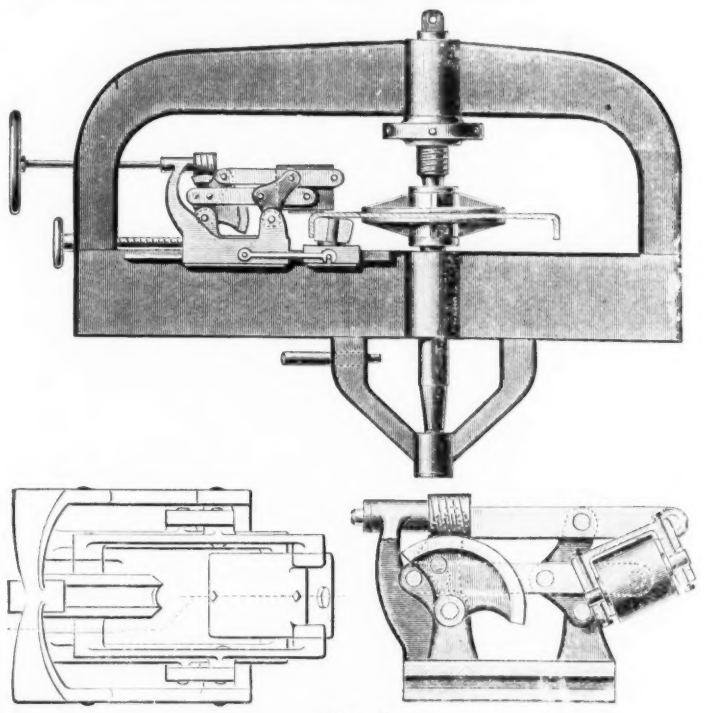
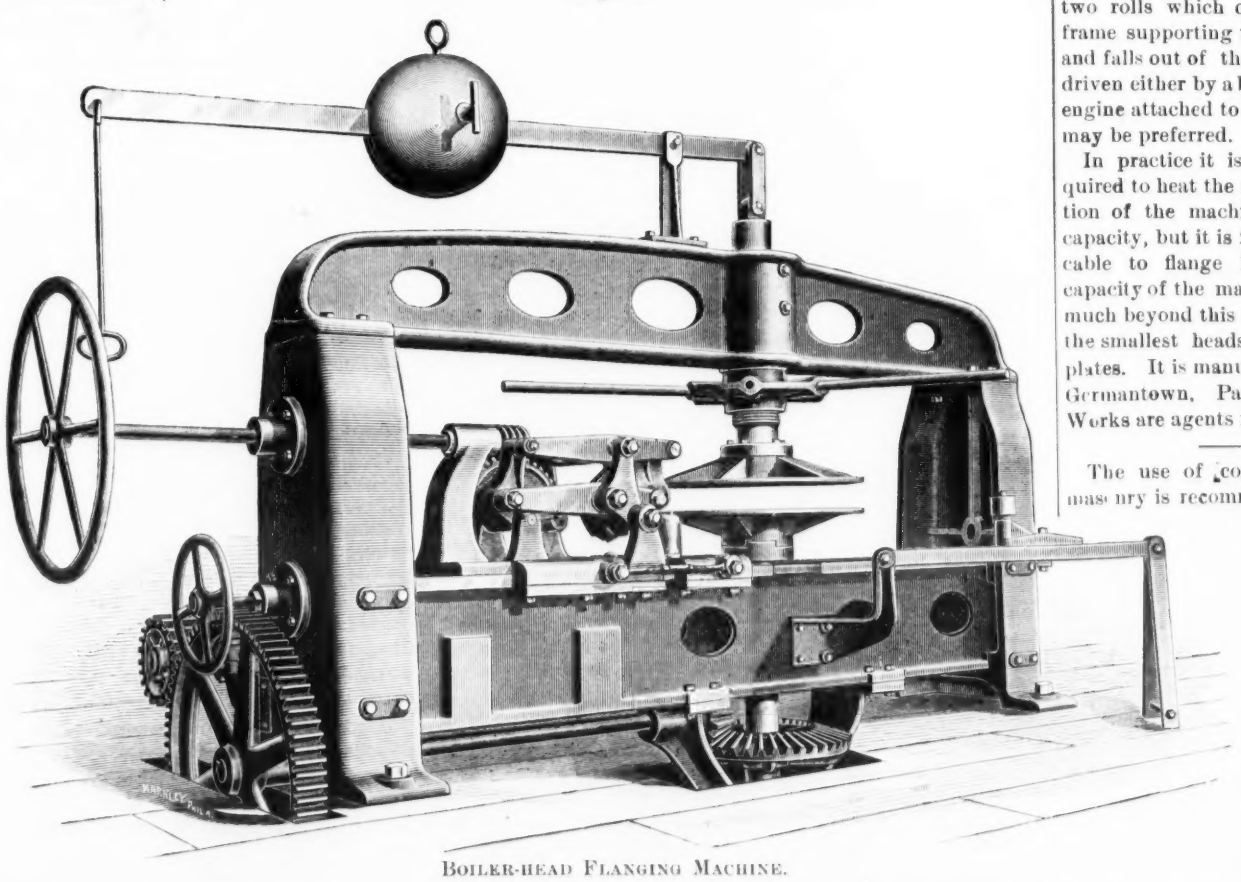


Fig. 2.



BOILER-HEAD FLANGING MACHINE.

Boiler-head Flanging Machine.

In our issue of June 19, 1890, we illustrated a boiler-head flanging machine, which in general appearance strongly resembled the present machine, but differed from it in some of the most essential points and in its method of operation. In the first machine it was necessary to use a former for each different size of head to be flanged, the plate being clamped between this former and a plain disk with the proper amount of metal projecting to form the flange, which was turned upwards by rollers, pivoted to a movable carriage in such a way that, by moving the carriage by one screw, and manipulating the rollers with another screw, two men at each side of the machine, or four altogether, could turn the flange, one of the principal difficulties being to get these four men to work in unison.

With the present machine the use of a former is done away with entirely, and the plate is clamped between two plain plates, which serve merely to hold it in proper position and give it a rotary motion, the turning of the flange being accomplished by two rollers, one of which is under the plate and revolves upon an inclined stud, as seen, the upper corner of this roller being rounded to the radius it is desired the inside of the corner of the head to be. This roller is set at the proper distance from the center of the clamping plates by a gauge provided for that purpose, its movement to or from the plates being effected by the lower and smaller of the two hand-wheels at the left of the machine. This adjustment made, the sliding carriage is clamped to the bed, and the flange is then turned by the movement of the upper roller, which is so suspended that it is at all times kept tangent to the outer curve of the corner of the head, the recently patented parallel motion by which this is effected being controlled by the larger of the two hand-wheels. This roll starts from a horizontal position, as shown by the uppermost view in Fig. 2, a subsequent position being shown below at the right, from which position it goes on in the same way until it stands vertically at the side of the first-named roller with the finished flange between them. The distance between the two rollers at this point is regulated by means of the right and left-hand connection in the rod which joins the two parts of the carriage.

It is at once seen that this device has very great advantages. The great expense involved in providing new formers for every different size of head to be made is entirely avoided, three sets of plain clamping plates being all that are needed for working to the full range of the machine. Again there is little or no side strain either upon the shafts which support the plates and the flange nor upon the carriage, the strain imposed upon one roller being met and balanced by the strain upon the other, without being transmitted through the frame of the machine. The machine is therefore economical of power, and is very easily handled, one man finding it an easy matter to manipulate the large hand-wheel. There is also very little, if any, tendency, to disturb the position of the stock within the clamping plates, so that much less pressure upon them is necessary. There is a centering device, part of which is shown at the right of the machine. The proper adjustment being made, the sheet is shoved against two rolls which center it, after which the frame supporting the rolls is kicked down and falls out of the way. The machine is driven either by a belt or by a small vertical engine attached to the shaft at the left, as may be preferred.

In practice it is found that the time required to heat the sheets limits the production of the machine rather than its own capacity, but it is found to be easily practicable to flange 100 heads per day, the capacity of the machine being, in fact, very much beyond this figure. Its range is from the smallest heads up to 84" diameter ¾" plates. It is manufactured by Jacob Clark, Germantown, Pa., and the Niles Tool Works are agents for it.

The use of coal tar for waterproofing masonry is recommended by a French technical journal. For surfaces exposed to the air it is advised to apply from one to three coats, boiling hot. Its durability is increased by adding a small proportion of india rubber dissolved in benzine. If the color of the coating is objectionable, it may be dusted with plaster of paris before drying. Where surfaces are to be covered with earth, a single coating of tar made thick by blazing is preferable. A small quantity—two or three gallons—is brought to a boiling temperature, and lit at the surface. It is allowed to blaze, and kept constantly stirred at the same time until the volume is considerably reduced, and it becomes pasty on cooling. The product is spread as rapidly as possible with a large flat brush, which is dipped often, to prevent cooling. A single coat applied in this manner adheres firmly to even the smoothest surface.

The men in the shops of the Lehigh Valley and Philadelphia & Reading Railroads are working on three-quarter time.

AMERICAN MACHINIST

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F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

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BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., or Stefanstrasse 18, LEIPZIG, GERMANY, will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, English currency, or 17 marks per annum, German currency, postpaid.

Subscriptions received in Paris, France, by E. TERQUEM, 31 Boulevard Hausmann, at 20 francs per annum, postpaid.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne,

NEW YORK, APRIL 28, 1892.

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Change of Location.

The next number of the AMERICAN MACHINIST will be issued from our new offices, 203 Broadway and 168 Fulton street, in the new building now being completed for the *Mail and Express*. While moving has become practically a matter of necessity, the present conveniences being inadequate to the comfortable and orderly dispatch of our constantly increasing business, we shall nevertheless leave our old quarters with a certain feeling of regret.

To every one connected with the paper there will always be pleasant memories of the old home and the old address with which the AMERICAN MACHINIST is identified in every country. The business and editorial offices of the paper were removed to 96 Fulton street when it was in its infancy, and it has continued to be issued from there up to the present number. From a modest beginning the paper has grown to its present standing, mainly in the place from which it is now about to be removed.

Here, on the 16th of February, 1880, in the rooms we then occupied and are about to leave, thirty mechanical engineers met and laid the foundation of the American Society of Mechanical Engineers—a society with the subsequent and present growth of which all our readers are acquainted; here the kind words and good wishes of friends have come to us without stint. We can only hope and trust that such words and such wishes will continue to greet us in our new home.

After May 1 our post-office address will be 203 Broadway.

The Mechanical Engineers' Visit to San Francisco.

On Wednesday, May 4th, many of the members of the American Society of Mechanical Engineers, living in the vicinity of New York, will start on what will probably be one of the most memorable trips taken by them in connection with the society. At 9.30 A. M. on that date they will leave on the West Shore road in a special train composed of Pullman sleeping, dining and drawing-room cars, for San Francisco, where they will arrive in time for the regular spring meeting, which opens on Tuesday, May 17th, in the Academy of Sciences building, or rather the sessions were to be held there, though it is not improbable that some change may be necessary in this part of the program, since the news comes that the recent earthquake shock wrecked one wall of the building. It will be noticed that the time intervening between the departure of the party from New York and its arrival in San Francisco will give opportunity for seeing something of the country *en route*, and we may be sure that all opportunities to do this will be made use of by the engineers, to whom an accurate and personal knowledge of the country in which their work is done is of considerable importance professionally as well as in a general way.

There is little doubt but that the trip to California will be very beneficial to all who participate in it, especially to those who visit that country for the first time, and will thus enjoy their first opportunity to see how the engineering problems which have been presented in that country have been solved. It is, of course, to be remembered that the society is not a local one, but is intended to cover the field of mechanical engineering in this country, and it is therefore, of course, well to arrange for covering the entire country so far as possible by the spring meetings, the bulk of the membership, which is in the eastern part of the country, being provided for by the holding of the fall meetings in New York, at the headquarters of the society.

The arrangements for such an extensive trip have been (very wisely, we think,) placed in the hands of men who make a business of arranging such matters, and Raymond & Whitcomb will have entire charge of the matter. Going, the party will keep together, but returning there is a choice of four routes by which members or their friends may be enabled to see any particular portion of the country which may attract them. At this writing over one hundred names have been recorded of persons who are going from New York and immediate vicinity, with a probability that others will be received as the time of departure approaches.

According to the itinerary, few if any parties of people have ever made the trip to California under more pleasant circumstances or better equipped for enjoying it, and yet making the best possible use of their time.

There are nineteen papers listed for presentation, six of which relate to steam or steam machinery, while the others cover a wide range of engineering, including the subjects of water-power, electric railways, utilization of the power of ocean waves, self-lubricating bearings, testing materials, machine molding, fly-wheels, friction in cable railways, aluminum, and refrigerating machines.

Another Piston Explosion.

According to an account published in the daily papers, three men were instantly killed by an explosion which took place in a machine shop in Lima, O., the cause being a piston from an old engine which had been put into the cupola. The dispatch says that the heat converted the water it contained into steam, causing a pressure which result d in the explosion, wrecking the cupola and killing the men by shock and red-hot iron.

The dispatch is unusually clear for a newspaper account of such an accident, and bears internal evidence of being correct as to the main facts.

The accident raises the question of the degree of responsibility which should rest upon men who allow such an accident to occur after similar accidents have been described and the causes which led to them fully explained in papers conducted with the special object of pointing out the right and the wrong way of conducting mechanical operations with regard to both economy and safety.

On Friday, the 18th of July, 1890, there was an explosion of a cupola in a foundry in this city, by which one man was killed and fifteen others injured. The cause of the explosion seemed a mystery, and the case was very carefully investigated by a representative of this paper, who laid the circumstances, with as much detail as possible, before our readers. This called out a number of letters from foundrymen and others, which were published in subsequent issues. The investigation made, and these letters, showed beyond the possibility of doubt that old hollow pistons heated in cupolas or in forges had frequently caused accidents which were destructive and fatal. It was clearly shown that the putting of such a piston into a cupola or forge without previously breaking it up, or venting the interior, was a very dangerous thing to do—almost as dangerous as placing a dynamite cartridge in the fire. Some years previous to this there were several accounts going to show the necessity of care in handling hollow pistons and plungers published in the AMERICAN MACHINIST, and quite extensively copied by technical journals.

Now at the time of the publication of this investigation and these letters, were the men who were responsible for the piston being put into the Lima cupola unable from any cause to read and know what was being said about the matter? And if they could have read it, but did not, from lack of interest in their business, to what extent are they responsible for the death of these three men?

We do not, of course, mean to assert that men should be compelled by law to read of matters pertaining to their work, but we cannot just see how one's conscience can be entirely easy who neglects this or any other reasonable means by which he can know what is going on; what is dangerous and what is not dangerous to himself and to those who may be to a greater or less extent dependent upon him for their safety.

And in the case of men who may be employed in manufacturing establishments, it is perfectly proper for them to call attention to the danger of any such proceeding which may happen to come under their notice, and if, after that, an accident occurs, their having called attention to it has usually a very great influence in the fixing of responsibility by the courts.

Machinery at Chicago.

We continue to hear of machinery manufacturers who are applying for space in which to exhibit machinery at Chicago, in the belief that all these applications are to be scaled down pro rata, *i. e.*, in proportion to the space asked for. It must be perfectly evident that if this plan is carried out the result will be anything but satisfactory, whether judged from the standpoint of the best interests of the exhibition or from the standpoint of the exhibitors.

There are plenty of men whose habit of mind is such that, without intending to be unfair or selfish, they will simply jump at conclusions regarding the amount of space required by them, and in applying will look out only that enough is applied for, thinking, if they take time to think much of the matter, that they will "fill it somehow." Others will go about the matter systematically; carefully consider what particular lines of machines should be exhibited by them, then what particular machines of each line should be exhibited, and finally how they can be best exhibited, the real purpose of such an exhibition and economy of space being kept in view.

It is perfectly plain that if applications of these two different characters, with others, are treated all alike, *i. e.*, reduced a certain fixed percentage, the result will be about as bad as it can well be, so far as the assignment of space is concerned. Under the operation of such a plan there will inevitably be those who will have far more space than they can utilize for the best interests of the exhibition, and, for that matter, of themselves, while others will not have enough to do either themselves, the exhibition, or American mechanical engineering anything like full justice. And one of the most deplorable features of the case is that the very best concerns—those whom it would be most desirable on all accounts to have fully represented, will in the main be the very ones who will be among the last-mentioned class.

In a former article (March 3 last) we have indicated a plan by which we believe this difficulty can be overcome. This plan is, briefly, to require every applicant to submit a figured sketch or drawing showing just what machines are intended to be shown, with such particulars of each machine, either by photographs, engravings or otherwise, as will enable men acquainted with machinery and its operation to compare and balance the merits of the various applications, assigning to each applicant, not a certain proportion of the space asked for by him, but that proportion of what he has shown that he actually needs, allowed by the dimensions of the building, or the total space available. This plan, we may add, has, as we know, received the approval of machinery manufacturers generally, who recognize the fact that some such plan is the only one that seems likely to result satisfactorily, if space is to be restricted at all, as, of course, it must be in any event. It is to be hoped that the present intention of scaling down applications uniformly will be abandoned, and that the more rational one we have outlined will be adopted. It must, of course, be evident that we can have no private axe to grind in this matter, but we believe our proposition to be for the best interests of all those who may have anything to do with the machinery exhibit at Chicago, whether as exhibitors, visitors or officials.

Literary Notes.

ELEMENTARY LESSONS IN HEAT. By S. E. Tillman, Professor of Chemistry, United States Military Academy. Second Edition, Revised and Enlarged.

The subjects treated on relate to thermometry, dilation of bodies, calorimetry, production and condensation of vapor, hygrometry, conduction, radiation, thermodynamics, terrestrial temperatures, aerial meteors, and aqueous meteors. The book contains some original matter, but the greater part has been taken from other works treating on the same subjects. The whole has been prepared, condensed, and the subjects treated with clearness and conciseness, to meet the necessities of a very short course of study at the Military Academy. It is well adapted for the use of students and teachers who have only a very limited time to devote to this branch of science, and yet desire a comprehensive and accurate presentation of facts as now known, and the theories now prevalent on this subject. Detailed descriptions of investigations and apparatus have been omitted. The discoveries of Professor Langley as to the length of heat waves and their absorption by the earth's atmosphere, and the chapter on aerial meteors, form very interesting and instructive reading. The book contains 162 pages, including index. It is published by John Wiley & Sons, 53 East Tenth street, New York. Price, $1.50.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(176) E. F., Providence, R. I., writes: Kindly inform me which is a good make of slide rule for a general mechanic; also a book treating on the same, and where it can be obtained. *A.*—The Mannhein slide rule is a popular one. The book by William Cox, noticed in our issue of July 2, 1891, is a good one. It is published by Keuffel & Esser Co., Fulton street, New York. Price, 50 cents.

(177) W. B. W., Portsmouth, Va., asks: Has there been a machine invented and placed on the market to run with springs or weights for driving a sewing machine or job printing press? *A.*—There have been some inventions in this direction, but we do not think that such machines are on the market. 2. What can I get for a cheap power when steam or electricity cannot be had in the daytime? *A.*—Perhaps either a gas, gasoline or hot-air engine will answer your purpose. If you are willing to make your own steam you might use a small steam engine; one with which gas or petroleum is used for fuel if you prefer.

(178) A. R. N., Union Society, N. Y., writes: I have an iron pipe ¾ inch inside diameter laid from a spring in a mountain to the house. The distance from the house to the spring is 3,000 feet, and the latter is estimated to be 150 feet above the end of the pipe where the water is discharged. The pipe discharges but 4 gallons per minute. Should it not discharge more? If so, how much more? How much power could be obtained from it, and how is it best utilized? *A.*—The discharge for a head of 150 feet should be less than 4 gallons per minute; you must be mistaken in the estimate of the head. The power of the amount of water discharged will be so small that it will be of no use for any practical purposes.

(179) W. L., Dayton, Ohio, writes: Please answer the following: The blacksmith in our shop says that, in making a wrought-iron band of any diameter, it is necessary to add to the circumference three times the thickness of the iron. For instance, to make a band of 1 inch square iron 5 feet inside diameter, there must be added to the circumference three times 1 inch, besides allowing for welding. What I wish to ask is, what is the reason for adding three times the thickness of iron to the circumference? *A.*—In bending the iron, so as to form a circular band, it is assumed that the inside surface is compressed as much as the outer surface is elongated, and therefore the length of the bar used for making the band or ring should be equal to the mean diameter of the band; that is, the diameter measured from center to center of the iron. If, for instance, the ring is to be 5 inside diameter, and is to be made of 1 inch square iron, then its mean diameter will be 5 feet 1 inch, and the length of bar should be equal to a circumference corresponding to a diameter of 5 feet 1 inch, or 61 inches; hence its length will be $61 \times 3.1416 = 191.63$ inches. According to the rule to which you refer, the length of bar will be $60 \times 3.1416 = 188.49$ inches; now adding three times the thickness, we have $188.49 + 3 = 191.49$ inches; the two results are practically equal. Of course this allows nothing for welding.

(180) R. F., Somerville, Mass., writes: Please inform me through your Question and Answer columns the advantage in using a duplex or group of safety valves in place of a single one. *A.*—The object of using more than one safety valve on a boiler is to provide an extra safeguard against an explosion. It is reasonable to assume that both valves will not get out of order at the same time; hence if one should fail to work the other still remains, to relieve the boiler of an excess of pressure. According to the United States regulations the area of the safety valve depends on the grate area; the former should not be less than one square inch for each two square feet of grate surface when a common safety valve is employed. Practice indicates that safety valves greater than 4 inches should not be used; hence in cases where safety valves greater than 4 inches in diameter are required, we should use two valves or more of a smaller diameter. It should also be remembered that the area of a safety valve increases as the square of its diameter. The circumference increases directly as the diameter; the escape of steam is around the circumference, and since the lift of a common safety valve rarely exceeds $\frac{1}{10}$ of an inch, often less, and since the lift is about the same for any diameter of a common valve, but varies with the pressure, it will be easily understood that for a given pressure the venting capacity of two valves is greater than that of one whose area is equivalent to the sum of the areas of the smaller ones. 2. I would like to have some information regarding the correct way to file circular saws. *A.*—Information of this kind is best obtained from experience.

(181) F. H. G., Columbiana, Ohio, writes: Please give the composition of Muntz metal and where it can be bought. *A.*—Muntz metal is thus described by its inventor: "I take that quality of copper known in the trade by the appellation of 'best selected copper,' and that quality of zinc known in England as 'foreign zinc,' and melt them together in the usual manner in any proportion between 50 per cent. of copper and 50 per cent. of zinc, and 63 per cent. of copper and 37 per cent of zinc, both of which extremes, and all intermediate proportions, will roll and work at a red heat; but as too large a proportion of copper increases the difficulty of working the metal, and too large a proportion of zinc renders the metal too hard when cold, I prefer the alloy to consist of about 60 per cent. of copper and 40 per cent. of zinc. This compound I cast into ingots of any convenient weight, and then heat them to a red heat, and roll or work them while at that heat into bolts and other like ship's fastenings, in the same manner as copper is rolled or worked, but only taking care not to overheat the metal so as to produce fusion, and not to put it through the rolls or work it after the heat has left it too much, say when the red heat goes off." In connection with this, Prof. R. H. Thurston, in *Materials of Engineering*, says: This alloy is cast into ingots, and rolled, hot, in sheets, which are cleaned by pickling, and washed, before they are sent into the market. As this alloy is cheaper and more durable than copper sheathing, and equally effective, it has displaced the latter almost entirely in the protection of wooden ships. When made on a large scale, the alloy is melted in a reverberatory furnace. It can be bought of any dealer in metals.

(182) Engineer, Boston, Mass., writes: Please give me the rule for calculating the stress on boiler braces used by the U. S. Government; also a rule for spacing and finding the diameter and number of stay-bolts. *A.*—The rule given by the Board of Supervising Inspectors of steam vessels is as follows: No braces or stays employed in the construction of boilers shall be allowed a greater stress than 6,000 pounds per square inch of section, and no screw stay-bolt shall be allowed to be used in the construction of marine boilers in which salt water is used to generate steam. But such screw stay-bolts may be used in staying the fire boxes and furnaces of such boilers, and not elsewhere when fresh water is used for generating steam in said boilers. From foregoing, the distance from center to center of braces can be found. For instance, let the diameter of the brace be ⅞ inches; its area will be .60 square inch; if, now, the pressure is not to exceed 6,000 pounds per square inch, then the stress in the brace must not exceed $6{,}000 \times .60 = 3{,}600$ pounds. If the steam pressure is 100 pounds per square inch, then the brace can support a surface of $\frac{3600}{100} = 36$ square inches. Assuming that the vertical distances between the braces are equal to the horizontal distances, then the distance between the centers of these braces will be the square root of 36, which is 6 inches. If screw stay-bolts are used in place of braces, then we must take into account the cross-sectional area at the bottom of the thread. Let it be required to find the distance between screw stay-bolts ⅞ inch in diameter, steam pressure 100 pounds. The cross-sectional area of the bolt at the bottom of thread will be say .44 square inch; hence, the stress should not exceed $6{,}000 \times .44 = 2{,}640$ pounds, and the surface which it can support will be $\frac{2640}{100} = 26.4$ square inches; the square root of $26.4 = 5.1$, which is the distance between their centers. Stay-bolts, such as are used in locomotive fire boxes, are not only subjected to a tensile, but also to a transverse stress due to the unequal expansion of the plates, and consequently they are spaced closer than the foregoing computations call for; the distance between these bolts generally ranges from 4 to 4½ inches. The diameter of the stay-bolts varies from ¾ to 1 inch. For thin plates the smaller diameter should be used, so as to bring the stay-bolts sufficiently close to prevent bulging of the plate.

(183) H. L. B., Cleveland, O., writes: I inclose a full size template of a cast-iron ⊥-beam. The flange at bottom is 3 inches wide by ½ inch thick, total depth is 4 inches, web ½ inch thick. The position of the neutral axis I find by balancing the template on a knife edge, and find it to be 1¼ inches from the bottom of the flange. The beam is to carry a uniformly distributed load of 3,400 pounds, but by my calculation I find that it is not strong enough. The span is 94 inches. I therefore intend to use a ⊥-beam with the bottom flange 4 inches wide and ¾ inch thick, total depth 5 inches, web ¾ inch thick. Please show how to compute the load uniformly distributed which the beam can carry, so that I can correct any errors of mine. *A.*—The load is computed by the following formula:

$$W = 8 \times \frac{S \times I}{l \times c}.$$

In which W is the load in pounds, S the unit stress on the fiber most remote from the neutral surface, I the moment of inertia, l the length of beam between supports in inches, and c the distance from the neutral surface to the most remote fiber. The moment of inertia we find to be 14.5; the weakest part of the beam is at the bottom, where the fibers are subjected to a tensile stress, which, for cast-iron, should not exceed say 6,000 pounds per square inch for a safe working stress, hence $S = 6{,}000$; the distance c from the neutral to these fibers is .83 inch. Substituting these values for the symbols we have: $W = 8 \times \frac{6{,}000 \times 14.5}{94 \times .83} = 8{,}920$ pounds, from which the weight of beam must be subtracted. 2. Please state what the modulus of elasticity is, and how it is found. I do not exactly understand the definitions given in books, and an illustration of some kind will help matters. *A.*—The modulus of elasticity is sometimes defined as the weight that would be required to stretch a rod one square inch in section to double its length, on the imaginary hypothesis that the law of elasticity holds good for so great a range. But we believe the following definition is a better one: The modulus of elasticity is the number obtained by dividing the stress per unit of area by a corresponding relative strain; and this is expressed in pounds per square inch. Thus a rod of wrought-iron ½ square inch sectional area being subjected to a tension of 5,000 pounds, it is found that a length which was 6 feet before tension is 6.002 feet during tension. The longitudinal strain or elongation is then .002 foot; and the relative longitudinal strain or elongation is $\frac{.002}{6} = \frac{.001}{3} = \frac{1}{3{,}000}$ of its length. It will be evident that if it takes 5,000 pounds to stretch a rod whose sectional area is ½ square inch, it will take 10,000 pounds to produce an elongation of $\frac{1}{3000}$ for a rod whose sectional area is one square inch. Hence by definition the modulus of elasticity (for tension) is $10{,}000 \div \frac{1}{3000} = 30{,}000{,}000$ pounds per square inch. The modulus of elasticity, frequently called the coefficient of elasticity, is usually represented by the letter E; if now P represents the weight in pounds which produces a certain elongation, A the sectional area, l the elongation, and L the length of the rod in feet, the foregoing is then summed up in the following formula:

$$E = \frac{P}{A} \div \frac{l}{L} = \frac{P \times L}{A \times l}.$$

Taking the same data as before, and substituting for the symbols their values, we have

$$E = \frac{5{,}000 \times 6}{.5 \times .002} = 30{,}000{,}000,$$

as before. The foregoing not only gives a definition of the modulus of elasticity, but it also shows the method of computing it, and the whole depends upon carefully conducted experiments.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Book, gratis; see page twenty.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

See Gage advertisement below.

Armstrong Tool Holder. Armst'g Bros., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Gage Tool Co.'s Self Setting Plane does more and better work in less time. On trial. Vineland, N. J.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back Pressure Valves. T. Kieley, 11 W. 13th St., N.Y. Send for des'n.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

25" / 32" / 37" / 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Complete treatise on Screws and Screw-making with clear and concise explanation of the methods: 95 illustrations. Price, $1.25 postpaid. E. & F. N Spon, 12 Cortlandt St., N. Y.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill, western agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau street, New York.
Send for Brief History of Patent Legislation.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY 96 Fulton Street, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic should miss. The cheapest work ever issued. 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Just Published: Safety Valves; their History, Invention and Calculation, including the most recent examples of Weighted and Spring-loaded Valves, also showing the effect of Atmospheric Pressure on Safety Valve Disks; showing the curious phenomenon of balls being sustained by an inclined current of air, Vacuum Valves, etc., etc., by William B. LeVan. Fully illustrated, pocket-book form, $2. Our Book Catalogue sent free. Norman W. Henley & Co., 150 Nassau Street, N. Y.

Transmission and Distribution of Power for Long Distances.

BY OBSERVER.

Using compressed air for power is an old device that has well served the mining engineer and tunnel driver for many years, though the expense attending the transmission has always been well known to its users.

Up to within the last four years, all underground operators were obliged to use compressed air largely in their workings, but in late years well-constructed electric plants have in a measure displaced a portion of the compressed air systems, except in the matter of rock drilling.

There is a large field of study before the engineers who have the task set for them to design and erect an *economical* compressed air plant that shall distribute say 50,000 horse-power through a large city. We must certainly look forward to and expect a great reduction in the cost of de-

livering this power compared with the *present* average costs.

The writer has operated a mining plant where one portion of the work was underground, and the other portion in open quarry, using four 3¼" rock drills worked by compressed air, and four drills of the same size in the quarry worked by steam taken directly from the boiler. Each system had its own boiler, the two boilers being of equal size. The drills and compressors were of modern build, and were constantly kept in good order. Every-day practice showed me that we used at least 30 per cent. less fuel on the boiler sending its steam direct to the drills in the quarry. The delivery pipes for the air and steam were of the same diameter and length, and both were covered and well drained. Perhaps I should have said in the beginning of this paper that I am not writing down one system, and in an indirect way attempting to boom another, and I will therefore say that up to date the writer thinks the "good old way" (expanded steam) is the most practicable method; yet, in spite of the opinions of many friends of the steam engine, it now looks as though our electrical brother was "getting there," and, judging from my personal experience, he is even now ahead of compressed air several laps.

I have not seen the Paris system, but I am informed that none of our American engineers would at this date think of adopting it for our large cities, smoke or no smoke.

This matter of the transmission of power for long distances has been in dispute, I think, long enough, and it should soon be settled by authoritative experiments conducted by one of the engineering societies, or by a testing jury selected from all of them.

Make a testing plant, for instance, for the transmission of 100 horse-power one and one-half or two miles, selecting any of the well-known water powers like Niagara Falls, Minneapolis or Holyoke, for driving the generators and compressors. The conditions could be exactly the same in the use of both systems, and thus perfect accuracy could be obtained.

As to the electric motors, it is now known that these machines are running in powers from 3 to 60 horse-power, doing shop and general factory service, and that they are showing an efficiency of about 82 per cent. as an average.

Electric motor builders are willing to install a mine pumping plant, and guarantee an efficiency of 75 per cent. The great German electrical power plant built last year is now running successfully, and, according to letters from Prof. Sylvanus P. Thompson, an exhaustive test has been lately made by Prof. Weber and his corps of Zurich engineers, which shows an efficiency of 72⅛ per cent.

The 113 horse power was generated at Lauffen on the river Neckar, and 81 horse-power was actually received at Frankfort, 110 miles distant from the generator.

I do not by any means intend to speak lightly of an old and long tried system, but I cannot see how the compressed air plant can be made to show proper economy, even in wholesale manufacture. It is not claimed that the use of compressed air will abate much more than one-half of the smoke nuisance, and to an outsider it looks as though compressed lightning would be better in the long run.

I would like to know what the readers of the AMERICAN MACHINIST think about this proposed compressed air distribution plant, because I may be "away off" in my conclusions. Where are the compressors in practice showing much over 60 per cent. efficiency?

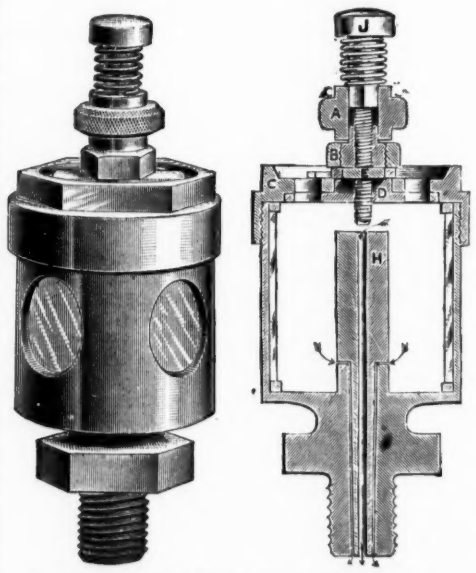
A Springfield, Ohio, dispatch says:

At 12.10 this morning fire broke out in the plant of Winters' Art Lithographing Company, and before the department could arrive the entire three stories were enveloped in flames. The fire originated in the stock room, filled with oil and ink, supposedly from spontaneous combustion. The building is a total wreck. The heavy machinery was ruined by dropping to the basement. The company had contracts for all the World's Fair lithographing. Part of the original stones for the World's Fair work were destroyed. Loss on stock and completed work, $40,000; on building, $10,000; on machinery, $25,000. Insurance, $5,000 on building, $30,000 on stock, $25,000 on machinery.

Safety Double-feed Crank-pin Oiler.

The engravings herewith presented show an oiler for crank-pins in which a double feed is provided, and in addition the feed is a forced one, these two features greatly lessening the liability of accidental stoppage of oil from clogging or any other cause.

The new oiler is the invention of S. Olin Johnson and William A. Downs, manager and superintendent, respectively, of the Penberthy Injector Co., of Detroit, Mich. Referring to the sectional cut, the concave cover which prevents waste of oil has both a filling and vent hole. It is therefore unnecessary to remove the cover except to clean the cup. The two holes referred to are closed by turning the ratchet *A* which revolves the under-valve *D*, covering the holes from the underside of the cover; at the same time the scutcheon *E* is turned, covering them from the top, thereby keeping out any dust. The feed is regulated by the ratchet *A*, which raises or lowers the regulating screw *J*. Resting on a square, it



SAFETY DOUBLE-FEED CRANK-PIN OILER.

is lifted from the same and admits of a regulation of ¼ of a turn of a spindle having 27 threads to the inch. This allows the plunger *H* to rise and fall any desired distance at each revolution of the engine to attain the proper feed, and, as will be seen by the cut, the oil enters at the arrows inside the cup and enters the wrist-pin at the arrows at the threaded end of the cup. The plunger *H*, it will be seen from its movement, forces oil to the wrist-pin.

It is manufactured by the Penberthy Injector Co., Detroit, Mich.

A Railway Supply Dinner.

Most gatherings of the kind known as "trade dinners" have more or less directly as their real or avowed object the getting of orders. An exception to this rule was one held in New York on the evening of April 22, at which no prospective buyers were present, and which was attended by the local representatives of a number of establishments interested in the manufacture and sale of railway supplies of the various kinds usually classed under that designation.

Its object was the very pleasant and commendable one of laying aside trade rivalries for a few hours, and cultivating the feelings of "sympathy and good fellowship," which are too often lost sight of in the stress of competitive business. A good proportion of the participants were present as representatives of establishments familiarly known to our readers. The affair was successful in every sense, the entertainment being enlivened by music and story-telling as well as speeches of a very enjoyable, even if not intended to be of a highly instructive character. It was voted to form a permanent organization, with a view to coming together annually in like fashion.

Brown & Sharpe's Enlargement.

Work on the three-story, 166x56 ft., extension of the Brown & Sharpe Manufacturing Co.'s No. 3 building, the stone foundations of which were laid last year, has been resumed, and it is expected that the structure will be ready for use in August or September. The principal object of the enlargement was to secure more room for storing patterns, 40,000 or more of which are in use, but space will be reserved on the first floor for bins for the molding sand brought from the North River, near Albany, N. Y. There will be four bins, each 12x24 feet, and ten feet in depth, the total capacity of which will be 600 tons. The sand will be loaded on dump cars at the roadway from Holden street, and conveyed along an elevated track, descending six inches to the hundred feet, to the top of the bins; and from the bins it will be taken through openings near the floor across the gangway to the foundry. There will be an office for the man in charge of the patterns and the remainder of the lower story will be used for storing the large patterns, and that part of the second and third floors above the sand bins is to be reserved for metal patterns. Shelves will be placed throughout the rest of the building, with passages between, so that ready access can be had to the thousands of patterns in regular service.

The extension, like the other buildings, will have iron stairways, and will be as nearly fire-proof as possible. It will be divided by brick partition walls, 12 inches thick, with double doors, so that in the event of fire the flames can be kept from spreading. The brick walls are to be 20 inches thick; there will be 20-inch iron girders resting on 12-inch columns on the first story, and 11 and 10-inch columns on the two floors above. The girders will support 15 inch I-beams, eight feet apart, and between these I-beams brick arches will be turned. The roof will be formed by turning a brick arch similar to those supporting the floors, and will be filled at the top of the beams with concrete, and covered with tarred paper and gravel. The water will be carried down through the columns.

The Promenade street end will cover the artesian wells from which the manufactory is supplied with water. There a trench has been excavated and the bottom covered with concrete. A brick arch will be constructed over the pipes, which will afford a passage-way four and a half feet in width, to be entered through an arched opening opposite the foundry.—*Providence Journal.*

MANUFACTURES

T. M. Lilliston has erected a machine shop at Suffolk, Va.

An electric light plant will be established at Wellston, O.

Miller & Jacharias will erect a machine shop at Reading, Pa.

The recently burned Franklin (Ky.) Woolen-mills will be rebuilt.

The Taunton Iron Works, Weir Village, Mass., have started up.

The Linden Steel Company will enlarge its plant at Pittsburgh, Pa.

B. M. Branner will probably erect phosphate works at Peru, Fla.

An iron foundry and machine shop is to be established at Rockland, Ga.

S. K. Allen & Sons will erect a foundry, machine and repair shop at Humboldt, Tenn.

The Stokes Foundry Company, of Alliance, O., will erect a new building this spring.

The Cincinnati Southern Railroad Company will erect a roundhouse at Lexington, Ky.

It is possible that the Belcher & Taylor Company may enlarge its foundry at Chicopee, Mass.

There is talk of the erection of a cotton-mill at Cameron, N. C. It is desired to enlist capital.

Carter & Co., of Summertown, Tenn., will erect a foundry and machine shop at Ethridge, Tenn.

The new works of the Fitchburg (Mass.) Steam Engine Co. will be in running order next week.

The Big Spring Ice Co., of Columbus, Ga., is erecting an ice factory in South Chattanooga, Tenn.

It is stated that a syndicate is being formed in Philadelphia to erect a big sugar refinery at that point.

The Albany (Tenn.) Waste Manufacturing Co. has been organized, to manufacture shoddies. Capital, $10,500.

The capital stock of the Johnson Foundry Co., of Johnson, Penn., will be increased from $50,000 to $150,000.

Chas. T. Holt and associates will erect a new cotton mill at Haw River, N. C., this spring and summer.

The Monterey Wire Nail Company has been incorporated at East St. Louis, Ill., with a capital stock of $300,000.

Endeavors are being made to organize a stock company to erect an ice factory and oil-mill at Itasca, Tex.

The Falcon Iron and Nail Company, of Niles, Ohio, are proposing to engage in the manufacture of tin-plates.

At Huntsville, Ill., a wire screen factory will be organized. It will be known as the C. E. Hastinggs Wire Screen Co.

It is reported that N. E. Ayer & Co. will establish a rolling-mill at Portland, Ore., for the manufacture of merchant bar-iron.

The Manistee Emery Wheel Co., of Manistee, Mich., are erecting a 30x50-foot building for the manufacture of emery wheels.

The Cumberland (Md.) Steel and Tin plate Co., a reorganized steel concern, will build two tin-mills, with a capacity of 1,000 boxes weekly.

The Rider Engine Works, Walden, N. Y., have commenced work on the new building to be erected for use in connection with the plant.

A report is in circulation that the Tennessee Coal, Iron and Railway Company will erect an iron furnace at Clinton, Tenn., in the near future.

The Scranton Axle Works, of Scranton, Pa., will build a considerable plant the coming season, for the manufacture of carriage and wagon axles.

A $60,000 stock company has been organized, to erect a cottonseed-oil-mill at Corsicana, Tex. Messrs. Scales, Culberson & Co. are interested.

The Jones Vestibule Sleeping Car Company, capitalized at $3,000,000, was recently incorporated at Denver, Col. Col. A. C. Fiske is an incorporator.

A meeting of the Llano (Texas) Improvement and Furnace Company was held on March 14th, at which it was decided to erect an 80-ton blast furnace.

The Gould Coupler Co. is building machine shops at its Black Rock works, near Buffalo, N. Y., at a cost of about $15,000, for the manufacture of the Cowell platform.

An effort is being made at Sandusky, O., to raise $150,000 for the purpose of inducing an eastern concern, known as the Aluminum Steel and Alloy Co., to locate there.

The Ashworth Machine Company is making rapid progress with the new factory at Fall River, Mass. An addition will probably be made to the new building a little later on.

The representatives of two Pennsylvania furnaces were at Big Stone Gap, Va., recently, with a view of locating two more blast furnaces at that point. Arrangements are now in progress looking to that end.

An addition, 170x51 feet, is being added to the machine shop of the Pusey & Jones Company, of Wilmington, Del. A 15-ton traveling crane and a 10-ton swing jib crane will be among the new equipments.

The Diamond Clamp and Flask Company, Richmond, Ind., manufacturers of pattern shop and foundry supplies, has issued a catalogue illustrating and describing the tools and appliances made at the works.

The Dora Furnace, at Pulaski, Va., is completed and already has on hand 700 tons of iron ore and a large amount of limestone stored in the stockhouse, and it is stated that within three weeks the furnace will be in operation.

M. C. Hammett, Troy, N. Y., is doing an excellent business in manufacturing the Richardson and Allen-Richardson balance slide valves. He has added new machinery, and is bringing out several specialties relating to railroad operating.

The Butman Furnace Company has been chartered at Chicago, Ill., with a capital of $50,000, for the purpose of manufacturing and dealing in steam boilers, furnaces and similar articles. The incorporators are Thos. R. Butman, E. C. Quimby and others.

Geo. B. Van Horn, Geo. A. Burr and E. Doughman have incorporated the Cincinnati Pure Aluminum Co., to erect and maintain reduction works, manufacture aluminum, etc., at Covington, Ky. The capital stock is $25,000; principal place of business, Covington.

The Rome Mfg. Company, which was recently incorporated at Rome, Ga., with a capital of $15,000, will at once erect a plant for manufacturing tea-kettles and boilers.

The Lodge & Davis Machine Tool Company, works, Cincinnati, O., have just closed a $7,000 contract with the Northington Munger Pratt Co., of Birmingham, Ala., for machine tools to be used in their new shops, for the manufacture of cotton ginning machinery.

The Standard Axe and Tool Works, of Ridgway, Pa., have just completed factories, which are 32x80 feet, and 18x24 feet, and an office. They are equipped with machinery for the present. Articles of manufacture are all styles of axes, mining picks, machine knives, etc.

A. Aller, 109 Liberty street, New York, has issued a new catalogue of engineering specialties for steam, water, oil, chemicals, gas, etc. He handles a large variety of steam jet apparatus, such as injectors, siphons, condensers, as well as other supplies.

The Standard Scale and Supply Company have been organized at Bellefonte, Pa. They are composed of William Burnside and Frank Gill, of Pittsburgh, and Harry Valentine, of Bellefonte, Pa. The works will be located in Bellefonte, while the general office will be at Pittsburgh.

Joseph Schneider, of Brooklyn, N. Y., and proprietor of the tin-ware works in Portland, Me., has a project to bring to Portland his enameling works, with their 200 to 300 workmen. This number will be increased to about 1,000 if the town will guarantee freedom from taxation for ten years.

There is water-works agitation in North Brookfield, Mass.; Spokane, Wash.; Huntington, L. I.; Hallstead, Pa.; Detroit, Mich.; Columbus, Ohio; Garrett, Ind.; Cambridge, Md.; Wyoming, Ohio; Bryan, Ohio; Stoughton, Mass.; Syracuse, N. Y.; Anacortes, Wash.; Canton, Ohio; Guthrie, Okla; Austin, Texas.

Merchant & Co., New York, Philadelphia and Chicago, send us a little pamphlet relating to "iridium" anti-friction metal, and babbitt metal in general. This firm also deals in seamless brass and copper tubing, copper and brass, wire rods, sheets, ingot brass, gun metal, phosphor bronze, etc.

W. C. Young, of W. C. Young & Co., manufacturers of lathes, at Worcester, Mass., has sold the business to the W. C. Young Manufacturing Company, of which he is president. The new company will extend the works, having already taken up the manufacture of shears and punches. The company has issued a catalogue illustrating and describing their last-named line of manufacture.

The Union Foundry and Machine Company, of Pittsburgh, have decided to engage in the manufacture of tin-plate machinery. At present they are building a part of the machinery to be used in the new plant of the Blairsville Rolling-mill and Tin plate Company, now being erected at Blairsville, Pa. It consists of a two-roll long sheet tinning pot, a five-roll improved Morewood pot and a pickling machine.

The Lunkenheimer Brass Manufacturing Company, of Cincinnati, Ohio, are preparing for the World's Fair an elaborate display of their popular specialties in valves, sight feed lubricators, oil and grease cups, etc. They will also exhibit a complete line of brass and iron goods, besides some novelties in steam whistles and sight-feed lubricators. They report business exceedingly brisk, being crowded with orders for their numerous specialties, and receiving large contracts for special work for United States cruisers.

Montgomery & Co., 105 Fulton street, New York, have issued a large volume of 700 pages, containing several thousand engravings and brief descriptions of machine tools, metal workers' tools, draftsmen's instruments; in fact, tools used in nearly all mechanical operations, both for the manufacturer and workman. The catalogue is very complete, showing a remarkably large and comprehensive line of goods handled by this firm; it shows great care in its preparation, and is an excellent book of reference for all manufacturers and mechanics.

Machinists' Supplies and Iron.

NEW YORK, April 23, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2 $14.75 to $15; Grey Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2 and $13 to $13.50 for Grey Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is easier.

We quote Hallett's, 10¾c. to 11c.; Cookson's, 14c. to 14½c; and L. X., 12¾c. to 13c.

Copper—The market is rather firmer, without actual business. There are bids for Lake Copper at 11⅞c., with 12c. to 12¼c. asked. Casting Copper is quoted at 11.35c. to 11.75c.

Lead—The market is stronger. 4.27½c. is bid, and 4.30c. asked.

Lard Oil—The market is firm at 56c. to 57c. for Prime City. Western on spot is quoted at 55c. to 56c.

Spelter—The market is unchanged, at 4.65c. for New York delivery of some brands, while 4.55c. is bid. Holders are still firm in their views.

Tin—The market continues strong, in sympathy with higher prices abroad, and speculative interest is more active. Sales have been made at 20.50c. Holders are asking 20.65c. to 20.70c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—3 exp'd mech. draftsmen for about 3 months. Geo. D. Dutton, Springfield, Mass.

Machinist, first class, on lathe work, desires a change about May 1. BOX 97, AMERICAN MACHINIST.

Wanted—Employment; 16 years' exp. in mfg., sale and erection of machinery. "Practical," AM. MACH.

Position wanted by a draftsman with experience and education. Address "Tool," AM. MACHINIST.

Mechanical draftsman wants situation; New York or vicinity. Address X., AM. MACHINIST.

Wanted—At once, a first-class pattern maker Good wages and steady job. Wm. A. Cather & Bro., Bluefield, W. Va.

Exp'd mechanical draftsman desires position in New York or vicinity, where part of time is spent in traveling or selling. B. C. D., AM. MACH.

Machinist and draftsman, 15 years' experience, wants situation as foreman or supt.; 5 years assistant supt. building pulp mach'y. L. N. Y., AM. MACH.

Wanted—Die makers; also man to take charge of die department. Only first class and competent men need apply. State wages expected, experience, etc. Location, Ohio. Diemakers, AM. MACH.

Wanted—A 1st-class man to run a Jones & Lamson 2x24 flat turret lathe. Address, giving past and present employers and amount of experience on this tool, Taunton Loco. Mfg. Co., Taunton, Mass.

Wanted—Machinist; a good vise hand and scraper, with experience in machine tool work; must be sober and steady. Address, with refs., The Henley Machine Tool Works, Richmond, Ind.

Wanted—By an experienced foreman molder, situation. Large exp. in loco., marine and stationary engine work, exp. in brass. Good references. Address Foundryman, care AMERICAN MACHINIST.

Wanted—Foreman. A live, energetic man, as supt. in a foundry doing engine and general mach'y business. Must be thoroughly posted in all modern methods in foundry practice. N., care AM. MACH.

Wanted—A good salesman for power-transmission machinery in New York and vicinity. Must be a prac. man, able to plan arrangements and estimate cost. Give age, exp., nationality, wages and refs. "Shafting," P. O. Box 3349, New York.

Wanted—A gentleman to take charge of and give instruction to students in a college foundry and pattern shop; salary, about $1,000 per year. Applications, stating age, experience, education, etc., of candidates, with testimonials, may be addressed to A. J. W., BOX 96, AMERICAN MACHINIST.

Wanted—Position as supt. or foreman, by a young man, successful in the systematic manufacture of machinery and mechanical devices, and in the economical management of men; a designer and draftsman of automatic and interchangeable machinery, tools, jigs, etc. W. S. H., AMERICAN MACHINIST.

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FOR 20 YEARS these Hammers have been in the market and during all that time have been acknowledged the very best. The material we use and our method of construction are the result of ripe experience and not the jumped-at conclusions of amateurs. Send for circulars and price lists.

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For Bolts.
AS USED BY
Machinists, Model Makers, Blacksmiths, &c,
HART M'F'G CO.
16 Wood St., Cleveland, Ohio.
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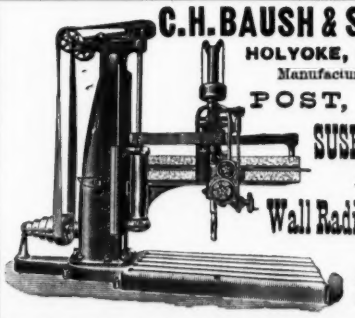
Manufacturers of
POST, SUSPENDED AND Wall Radial Drills
From the smallest to the largest.



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One 8vo Vol., with Plates. Price $2.50.
Copies sent by mail or express on receipt of price.
D. VAN NOSTRAND CO., Publishers and Importers,
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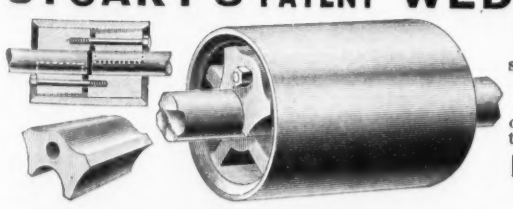

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Can be attached or removed in a few seconds without injury to shaft or coupling.
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Also the Cheapest. 2-inch, only $4.50; other sizes in proportion. Send for Illustrated Price List of 20 sizes.
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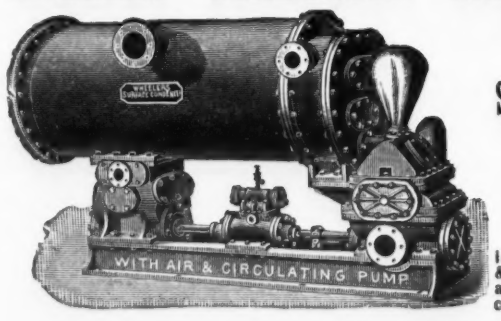

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We will sell a 52" Radial Drill with arm to move up and down the Column for less money than you can buy a 40" Upright Drill for. Has table arm that moves around column, and table revolves in arm. The Radial Arm is balanced, has Power Feed to Spindle, and is powerfully driven, has great stiffness; no spring to Radial Arm under heavy pressure. Has heavy base plate. Truth, accuracy and workmanship of the best. Note following testimonial.

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Manufacturers of MACHINISTS' TOOLS,
CINCINNATI, OHIO.

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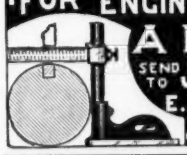
Gentlemen:—I am pleased to say that your Radial Drill is all you claim for it. Respectfully,
OHIO MACHINE TOOL CO.
PER WM. LODGE.

PAT. KEY-SEAT SETTING GAUGE FOR ENGINEERS & MACHINISTS



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THE BENNETT BUILDING, 93-99 NASSAU ST., N. Y.
Monument Chambers, King William St., London, E. C., England.

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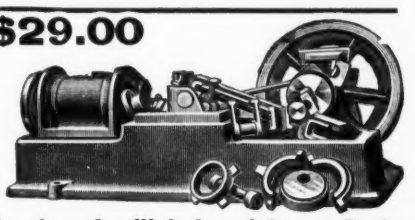

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Sets of Castings for Engine illustrated above, with *Cast-steel Shaft, Connecting Rod* and *Rock Shaft* and *Brass Bearings*, boxed and shipped on receipt of $29.00. Three sheets *blue prints* of working drawings extra.

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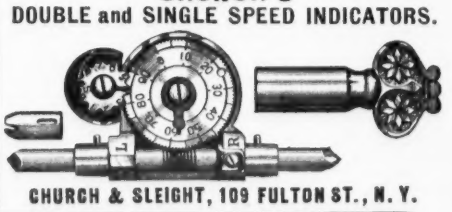

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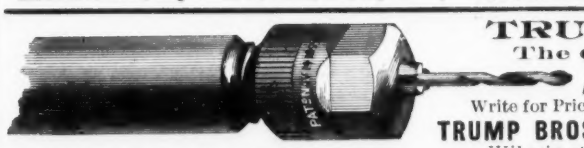

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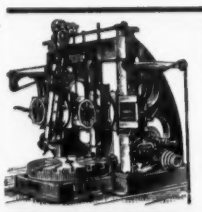

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Wanted—Pos. with firm making hoisting mach'y for electric, hydraulic, steam and hand power, by draftsman with large exp., tech. education, used to making calculations & estimates. Crane, AM. MACH.

Wanted—Foreman of machine shop, in an engine works in the East, employing 200 to 300 hands. Must be familiar with interchangeable and jig work, piece work and other modern methods, and capable of handling men to advantage. Address Box 95, care AMERICAN MACHINIST.

Wanted—An increase of force in machine shop in Western Pennsylvania as follows: Six first-class general machinists—one to erect machinery outside, one good pattern maker, one draftsman, one good blacksmith for machine and car work forging. Address Force, AMERICAN MACHINIST.

Situation wanted by an educated mechanic who has had extended experience in shop management and as draftsman—particularly in the line of machine tools and special machinery. Also experienced in high-grade stationary engine work. Address Box 98, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.
Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.
Best Crank Shaper $225. Am. Tool Wks., Clev., O.

Machine Tools in Stock.

ENGINE LATHES.

82 in. swing,	34 ft. bed.			Whittier
78 do	9 ft. between centers			Sellers
38 do	17 ft. bed.	New		Fifield
30 do	14 do	do		do
27 do	16 do	do		
24 do	12 do	do		Fifield
24 do	12 do	do		Fitchburg
24 do	12 do	do		Flather
22 do	10 do	New Pattern		Fifield
22 do	12 do	do		do
22 do	12 do	New		Blaisdell
22 do	8 do	do		Flather
22 do	10 do	do		do
20 do	8 do	do		do
20 do	10 do	do		do
18 do	8 do	do		do
18 do	10 do	do		do
18 do	8 do	do		Blaisdell
18 do	15 do	do		do
16 do	6 do	do		Flather
16 do	6 do	do		Blaisdell
15 do	6 do	do		Flather
14 do	6 do	do		do
14 do	6 do	do		Blaisdell
12 do	6 do	do		do

PLANERS.

42 in. wide,	42 in. high,	12 ft. long,	2 heads	Gleason
36 do	36 do	8 do		Pease
30 do	30 do	8 do		do
30 do	30 do	8 do		Whitcomb
30 do	30 do	8 do		Flather
26 do	26 do	6 do		do
24 do	24 do	6 do		do
24 do	24 do	6 do		Whitcomb
22 do	22 do	5 do		do
22 do	22 do	6 do		Flather

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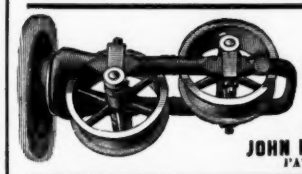

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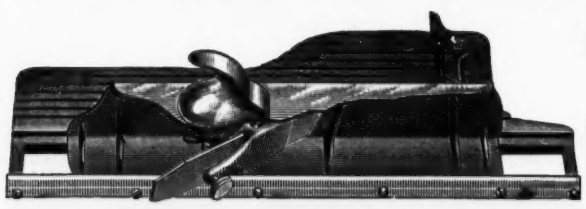

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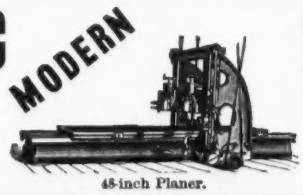

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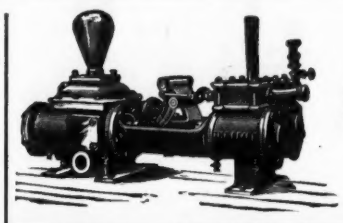

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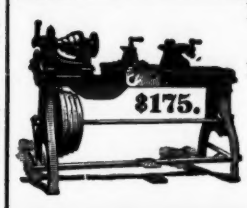

Improved Screw Cutting Foot and Power.
LATHES

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

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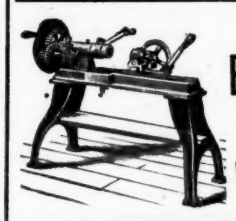

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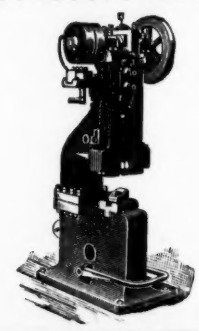

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The operator can control perfectly the force of the first or any succeeding blow and stop the hammer instantly.

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How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.

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Sole Representatives in the United States.
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METAL-WORKING
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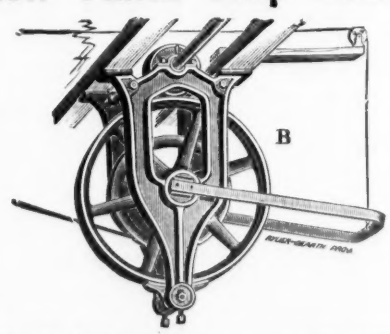

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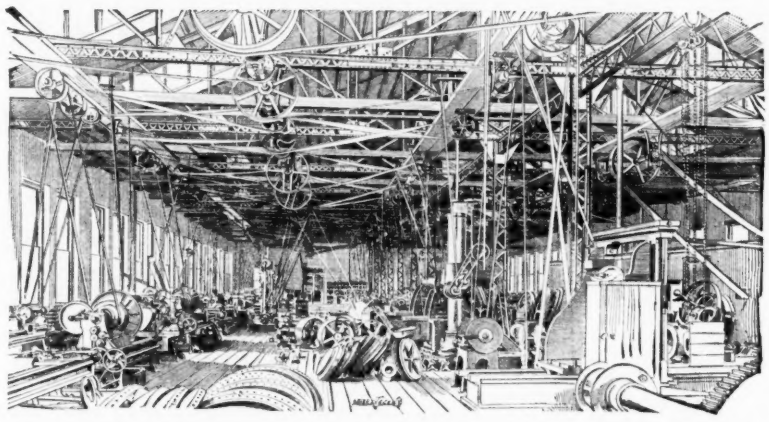

The above illustration is taken direct from a photograph, and shows the interior of a Machine Shop, the roof of which was designed and built by us for The Titusville Iron Co., at Titusville, Penn. The building is 70 ft. in width by 205 ft. in length. The roof trusses are made entirely of iron, and designed to carry shafting. Through the center of the building is a row of wrought iron columns. Machine Shop roofs built after this plan are not only much neater in appearance than heavy, cumbersome, wooden trusses, but are stronger and stiffer; and where no wood is used about the construction, the danger from fire is entirely eliminated.

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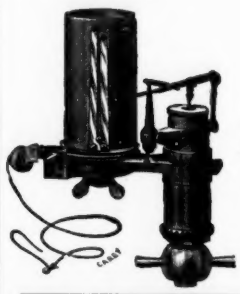

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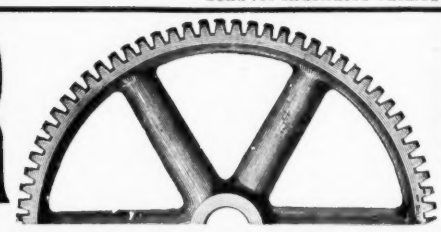

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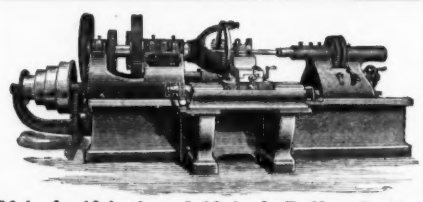

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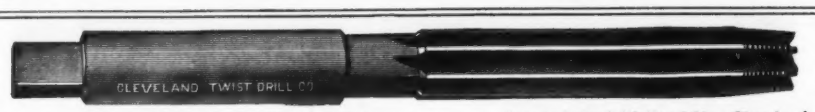

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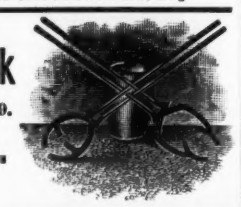

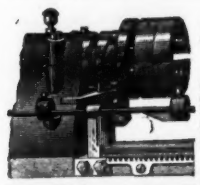

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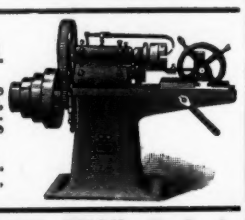

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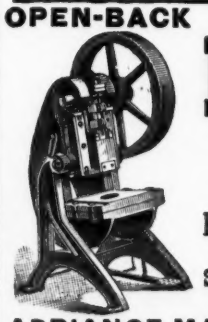

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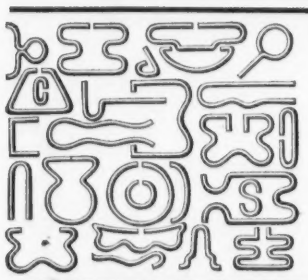

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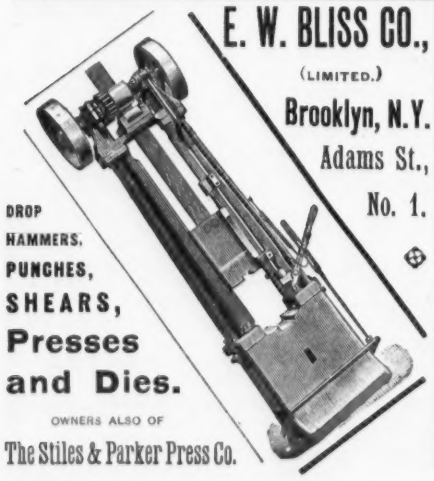

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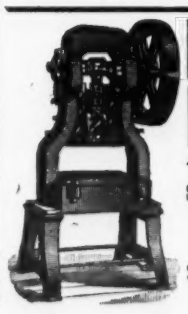

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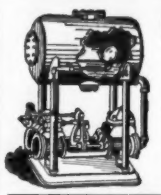

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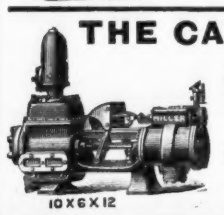
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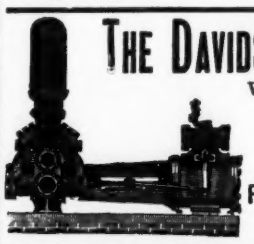

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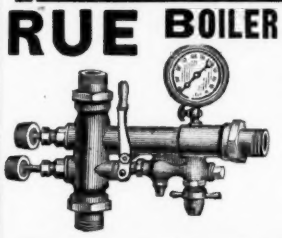

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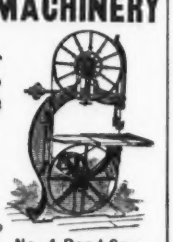

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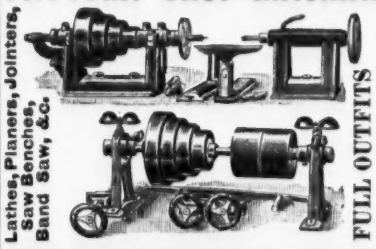

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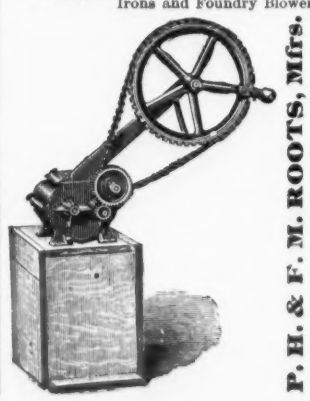

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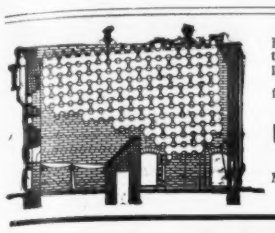

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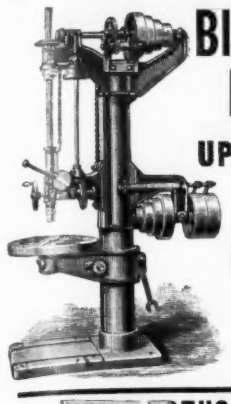

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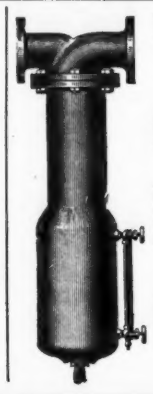

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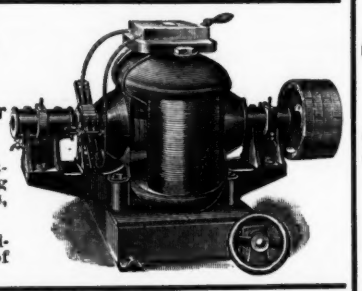

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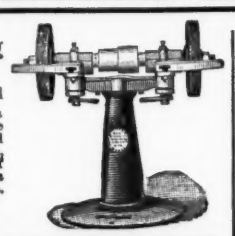

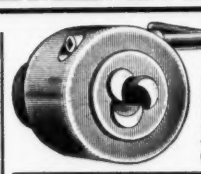

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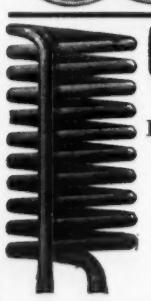

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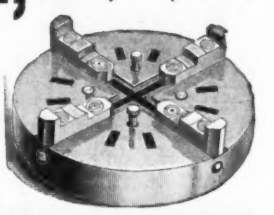
30 "	32½ "
36 "	40 "



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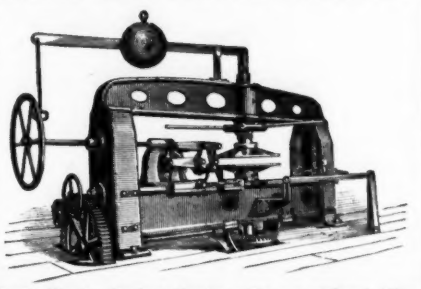

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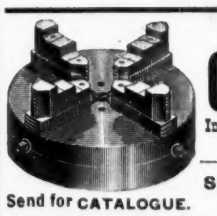

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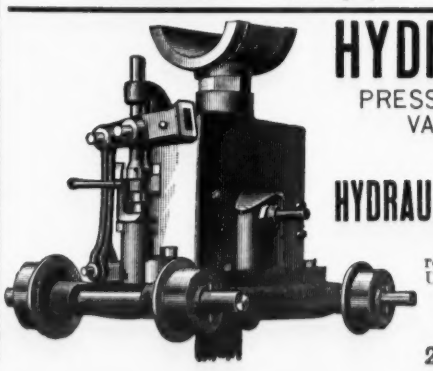

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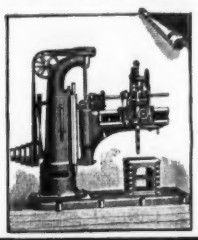

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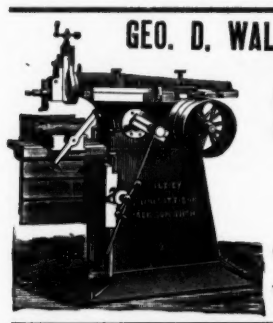

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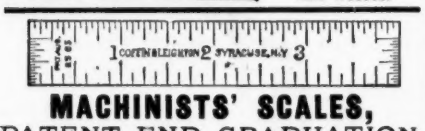

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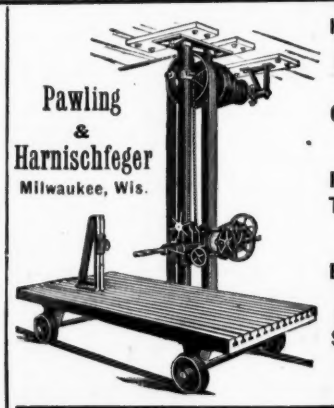

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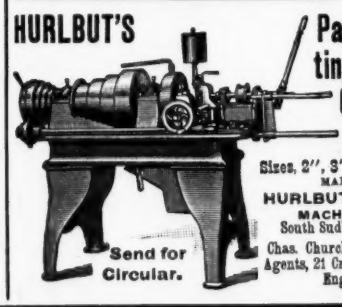

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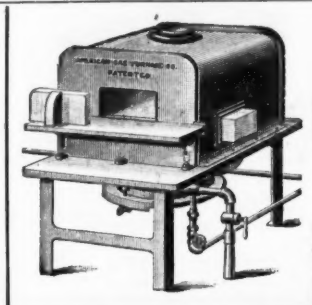

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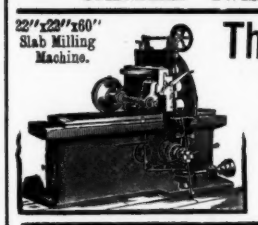

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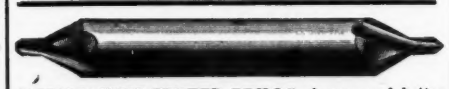

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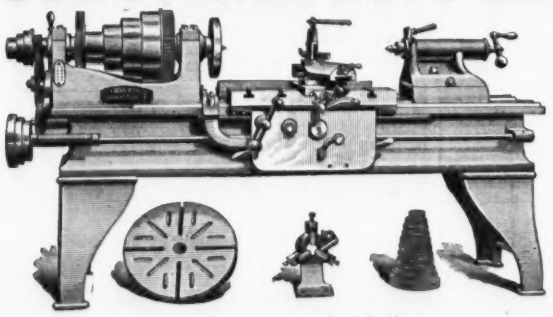

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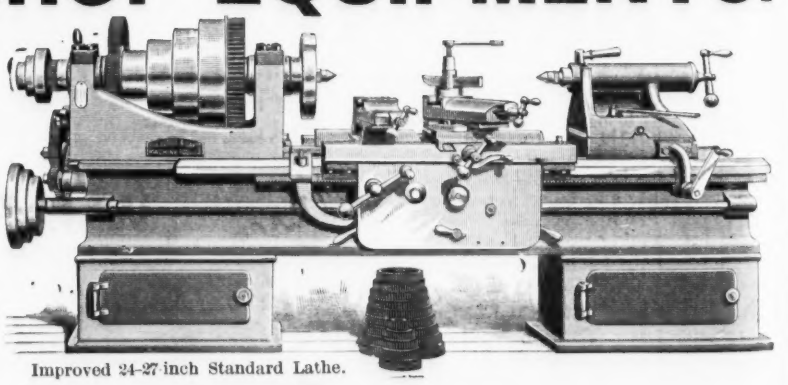

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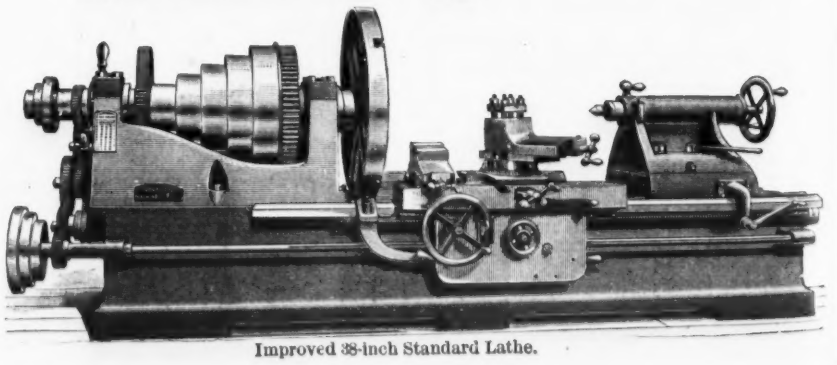

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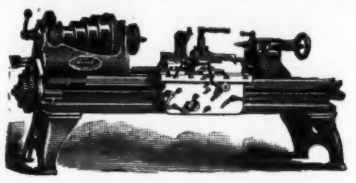

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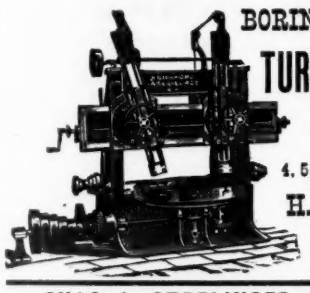

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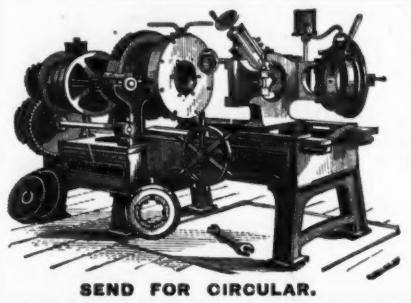

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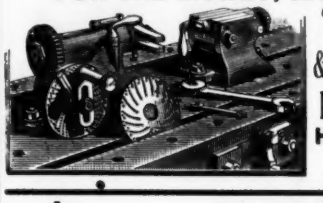

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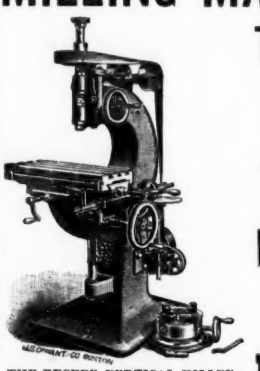

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Respectfully yours,
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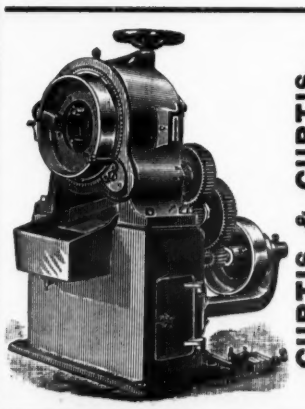

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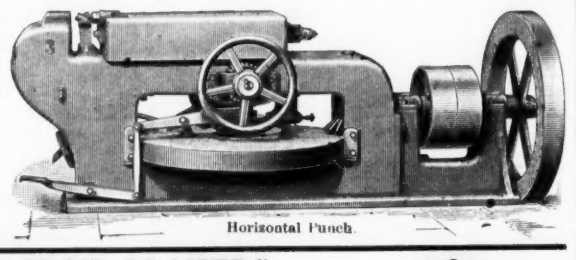

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Yours truly,
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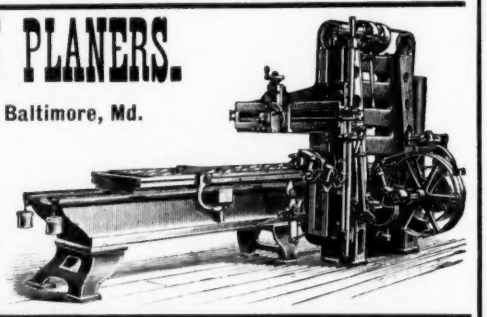

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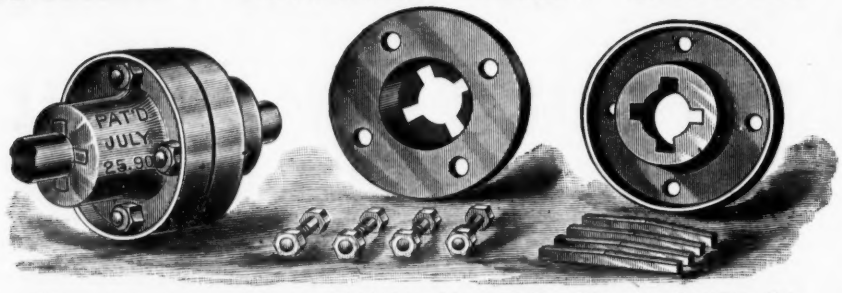

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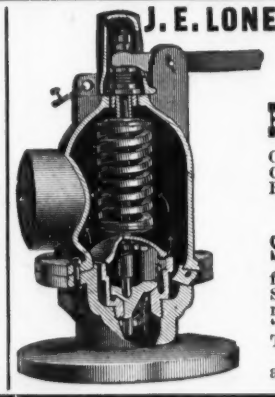

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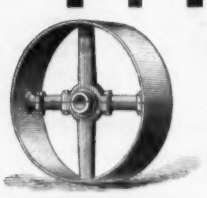

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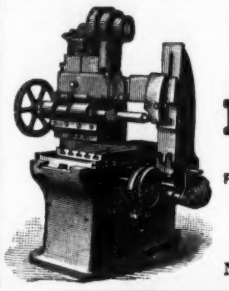

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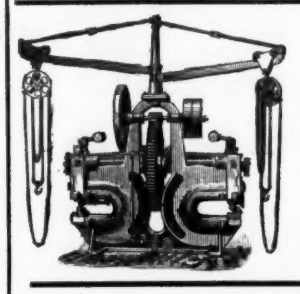

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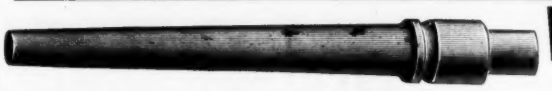

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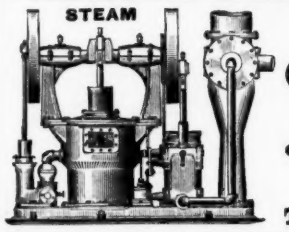

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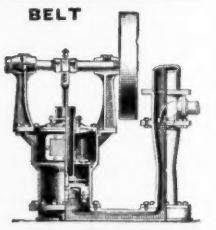

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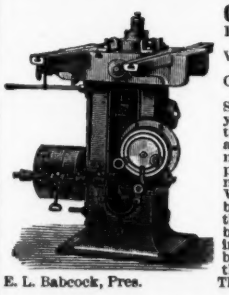
E. L. Babcock, Pres. The Falls Rivet & Machine Co.



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We are well satisfied in every respect with the workings of the machine, and can say that it is by far the best machine that we have ever used and do not think there is a machine made to equal it.

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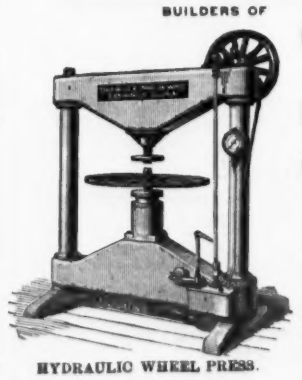

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Will cut through 4-foot hub, through 5-inch hole. Our new centering chuck and setting attachment the work can be set exactly, without the use of a scale or rule. Our new binding attachment takes the place of bolts, with a key-way and key to fit it.

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For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.

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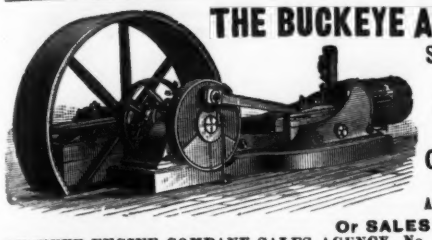

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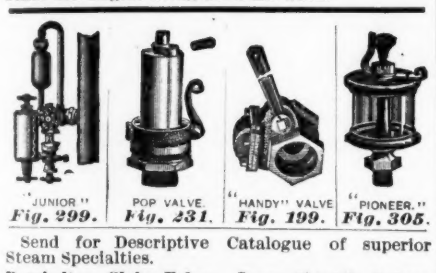

"JUNIOR" *Fig. 299.* | POP VALVE. *Fig. 231.* | "HANDY" VALVE *Fig. 199.* | "PIONEER." *Fig. 305.*

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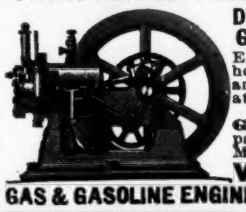

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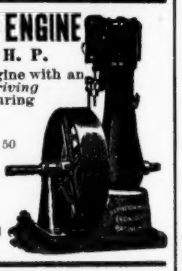

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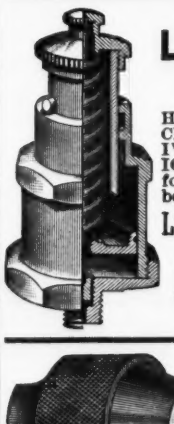

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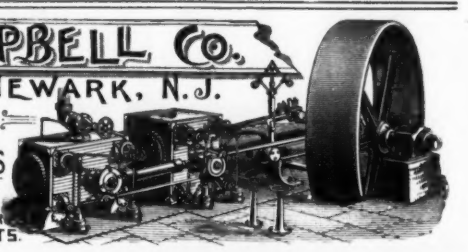

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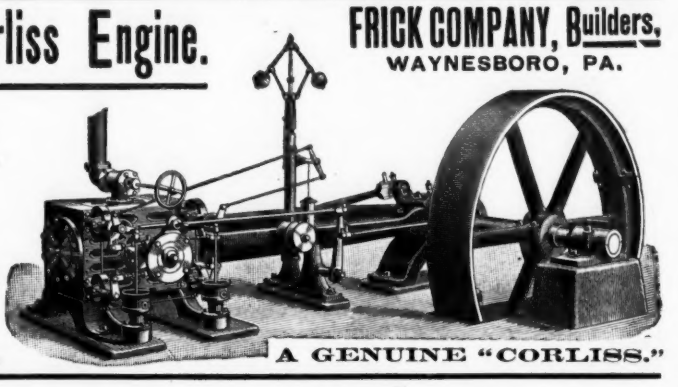

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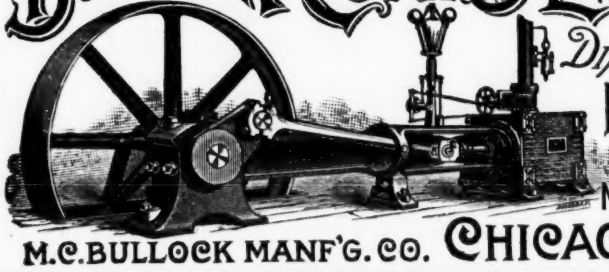

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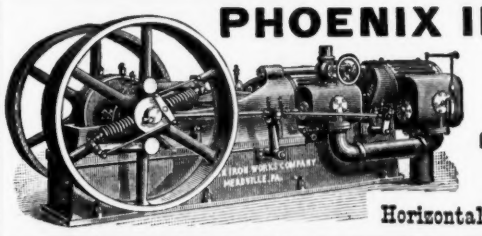

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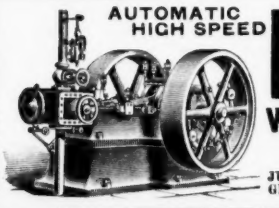

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THE IMPROVED BALL ENGINE.

AS BUILT BY
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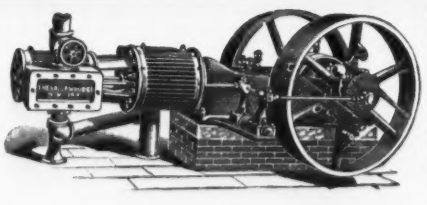

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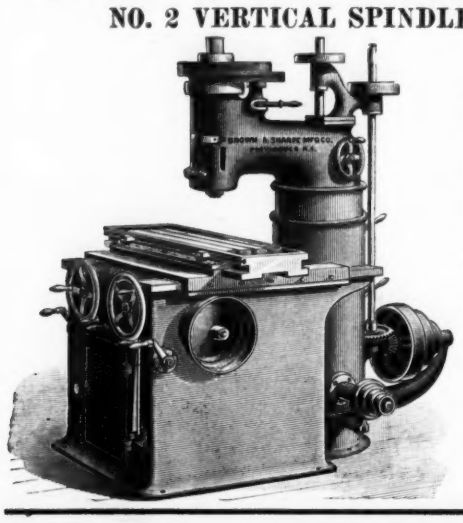

This machine, for many kinds of work, is preferable to a machine with a horizontal spindle. The operator can more clearly and easily see the work and more readily follow any irregularity in the outline of the surface to be milled.

The Platen is gibbed solidly to a broad and substantial base and rests upon flat and ample bearings. It is 41 inches long and 13¾ inches wide, and is fed in either direction automatically or by hand. It has eight changes of speed for each speed of spindle.

The spindle has three belt and three gear speeds, which, with two speeds of counter, make twelve speeds in all. At its lowest position the spindle is 1½ inches and at its highest 15 inches above the platen. Cutters up to 8 inches diameter may be used in surfacing.

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Floor space, 82x78 inches.

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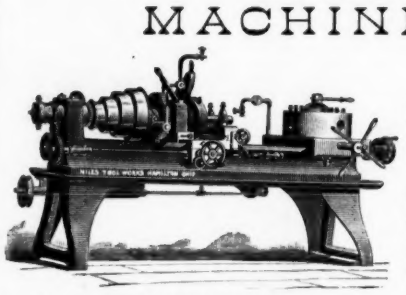

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For the twofold purpose of obtaining valuable statistics, and to encourage the men now operating the tools, we offer the following rewards: **$50.00 to the first; $25.00 to the second; $15.00 to the third, and six additional prizes of $10.00 each, to the men who, before July 1st, 1892, turn out the largest day's work on one of these Standard Lathes.** All character of work will be considered, and the names of the successful competitors will be published in the American Machinist. No proprietor or foreman of a shop will be eligible to a prize, but the amount of work must be endorsed by a proprietor.

Communications may be addressed to the Works or any of our Stores.
☞ Printed Copies of this reward furnished for posting in shops.

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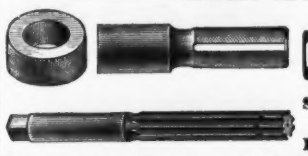

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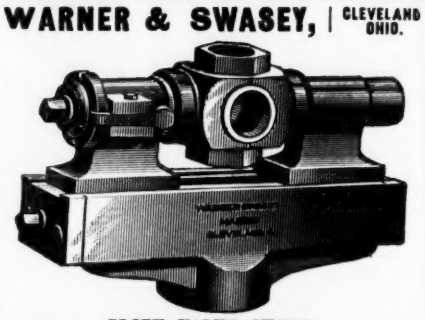

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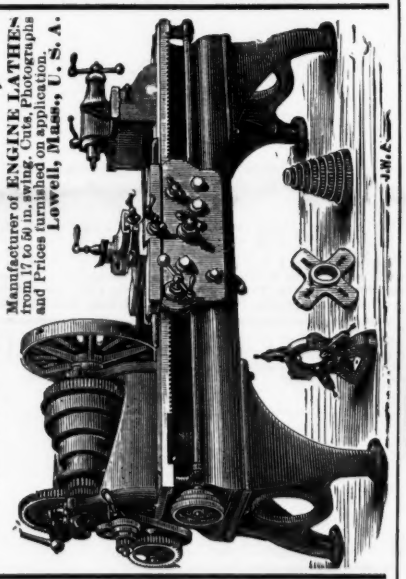

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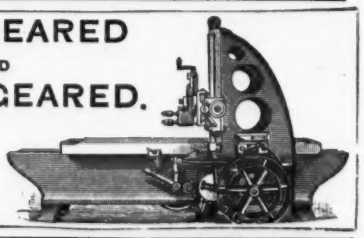

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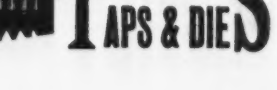

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